

# COST OPTIMIZATION AND WORK QUALITY IMPROVEMENT OF SMALL AND MEDIUM ENTERPRISES IN SERVICE ACTIVITIES BY USING A WEB APPLICATION

Bruno JAMAN, Dominika CRNJAC MILIĆ, Krešimir NENADIĆ

**Abstract:** The aim of this paper is the development of a web application for ordering in the service sector of small and medium enterprises with the purpose of optimizing the opportunity costs. A special focus is placed on the amount of services rendered, which increases with the minimization of cancelled orders that are not timely replaced with new ones, but also on the quality control of the performed services that reflects on the motivation of employees or their replacement with new ones in order to improve the business. The following web technologies were used while developing the web application: HTML, CSS, JavaScript, PHP and MySQL. An insight into the technologies used to create web applications is given and some of the basic concepts used in the web application are explained. The paper describes the functionality and design of the web application. The analysis of cost effectiveness through managerial control, management systems, digitization of businesses and employees evaluation is given. The functionality of this web application is aimed at small and medium enterprises engaged in the service industry.

**Keywords:** database; digitization of business; service sector; small and medium business enterprises; web application

## 1 INTRODUCTION

The idea to write this article derived from the hypothesis that there is a need for more control and evaluation of employees of small and medium enterprises (SME) in the service sector in order to achieve competitiveness in the increasingly complex market competition in a time of economic crisis. Furthermore, another reason lies behind the fact that the ICT technologies can be of great importance without the company management having to make significant investments. As a result of the research and writing a master's degree thesis, a web application was designed in order to allow the persons in charge of controlling the employees to quickly and easily, without any particular knowledge of ICT, perform the function of controlling the operation of the company, employee evaluation and quality control of the performed work, which today are some of the factors that the survival of SMEs depends on.

The main function of a web application is to optimize time and resources in the work of employees in order to reduce the opportunity costs, i.e. the missed revenue resulting from poor employees operating the time distribution system and services that are provided with a certain quality.

The main goal is to minimize the number of cancelled orders by reminding users of their appointments, but also by offering an alternative service operator within the same enterprise.

On the technical side, the challenge is the database structure that will contain information about the contracted period in which the job should be performed, customers, employees and their working schedule, and a system that will manage the data and distribution of the upcoming requirements (events).

### 1.1 Technologies used to develop a web application

*HyperText Markup Language* (HTML) is the base in developing web applications [1]. HTML is not a programming language but a descriptive language used to organize webpage content. The web browser communicates with the web service and receives content as a list of elements to be presented to the user. The presentation of elements is organized by using CSS.

*Cascading Style Sheets* (CSS) is a descriptive language used to influence the presentation of the HTML elements [2]. It can be used to define different rules for a different kind of HTML document elements, such as: text and background colours, background images, fonts, text presentation and many more rules. The advantage of CSS is that it can be written in a separate file and then applied to any HTML document. This results in the reusability of the CSS code for any target HTML document. CSS can also be used to format the design of an HTML file depending on the type of the medium where the content is displayed [3].

*PHP: Hypertext PreProcessor* (PHP) is an object-oriented script language used to write the server script code. Such a code is executed on the server side and the result is shown on the client side (web browser). It was designed by Rasmus Lerdorf and the first version was published in 1995. The use of PHP scripts results in dynamic webpages. Server script can generate some output that depends on the user input from the forms in web documents [4]. PHP scripts in this paper are used for database communication and management.

In order to use database functionality, a database management system service, in this case the Relational Database Management System (RDMS), has to be installed on the server. The most common and most widespread open source database system is MySQL (*My Structured Query Language*), developed by Oracle. A database is a structured

set of data consisting of at least one table. The MySQL databases usually consist of more than one table [5].

The database is relational, which means that there are some rules for relations and interactions between the tables. The data from one table can point to some data in the other table (one-to-one relation) or they can point to several different data in more than one table (one-to-many relation). In the database designing process, the rules and data types that are in certain columns of the tables are created in order to allow the writing of only the defined data types in the tables. The database is well-designed if the database structure and rules are well-defined by the designer (programmer). The number of columns in a table is limited to 4096 and the row size to 65535 bytes [6].

In addition to HTML and CSS, JavaScript is one of the three key technologies of the client side Internet programming. It is used in the vast majority of webpages and is supported in all web browsers. It first appeared in 1995 as the Netscape Navigator browser functionality. Although it is named like Java, the two languages are quite different in their functionality. JavaScript provides additional dynamic functionality for webpages. The JavaScript library jQuery was used to facilitate the webpage functionality development. JavaScript has access to all objects that are part of the document and it thus enables an easy access to all parts of the document.

XAMPP (eXtensible Apache MariaDB/MySQL PHP Perl) is an open source, multiplatform application developed by Apache Friends. It consists of the Apache web server emulator and PHP, Perl and MySQL (or MariaDB in the newer versions) modules [7]. It is used as a server emulator to test the server side functionality of the developed web application.

## 1.2 Goals of the developed system

The system was developed to meet several goals. It has to be applicable to the service sector of the SMEs and it has to be easy to use without much knowledge or additional training in the field of ICT. In addition to that, the system has to be easily adaptable to various service activities. The result should be a system ready for use in companies engaged in the service sector with the potentially minimal changes with respect to the type of services provided to customers. In order to achieve this, it was necessary to include a content management system in the application.

## 2 APPLICATION FUNCTIONALITY

The application functionally is divided into two parts. One part of the application is available to the customers and the other part is available to the administrator, but also to the employees if the company wants it so. The access to the client part or the administrator part of the system is determined by the value of *authority* variable from the database table *'users'* for every single user.

The administrator has the privilege to change the type of services, add or delete employees and to make any

changes to the system. By performing such modifications, changes are instantly visible throughout the whole system.

Before one can use the system, it is necessary to register and create a user profile. After the registration is completed, the customer can log into the system and choose one of the two tasks: to schedule a new appointment or to browse through the existing appointments.

A new schedule for the client is requested through an interactive web form. The client first chooses the type of the required service and after that, all available employees that support the required service are dynamically added to the form so the client can choose one of the available employees. The next feature that the client has to choose is one of the available dates for the requested employee and service. As the last part of scheduling appointment, the client has to confirm the requested service, employee and date by clicking on the confirm button. The client also has the ability to browse through the requested appointments and cancel them through the web form.

There is an administrator panel accessible only to the users with administrator privileges. The administrator panel consists of features used to manage the employees and their working hours, but it also gives an insight into the analysis and statistics of the provided services and employees who perform those services. The emphasis is placed on the simplicity and intuitiveness of the administrator's part of the web application so that no additional training concerning ICT is necessary to manage the application or to adapt the application performance to the needs of the company. The only skill necessary to work with the web application administrative panel is the basic knowledge needed to work on a computer and the knowledge of the use of the Internet (web browser).

One of the features is to manage the activities (services). Along with the overview of activities, it is possible to delete an existing activity or change the previously given service price. It is possible to add a new service and to set its price.

The employees' management gives insight into the total number of employees, their scheduled appointments, service management supported by the current employees, deleting employees and scheduling the employees' working shifts. Adding new employees to the services that they are trained to provide is available through the administrator panel. It is available to mark a scheduled appointment as finished (held) and finished appointments are not listed in the scheduled appointments overview, but they are kept in the database in order to keep track of all the finished appointments when analysing the employees and services.

The timetable provides insight into the free and reserved employees' periods of time for the selected month.

The last administrator panel feature is the display of statistics for the individual or overall staff and for the service analysis. The displayed information include the total number of scheduled appointments for a specific service or employee along with the total income realized from one or all services of one or all employees together.

## 2.1 Application and database structure

Bootstrap was used to design the application's layout with some modifications in the CSS files. Web application content (HTML code) is dynamically generated by using PHP, JavaScript (jQuery) and data from the database. Any change in the employees' data, services or working hours by the administrator is momentarily recorded in the database and used in code generation in the following requests for services.

Database operations are realized through PHP/MySQL and the majority of web forms are dynamically generated with the help of jQuery.

The MySQL database is the main and most complicated part of this web application. The database consists of five tables: users, employees, services, timetable and scheduled appointments.

The table *users* contains information about the registered users who use the provided services and other users of the application such as the administrator and employees. Each user is identified by the unique ID in the *users* table and other tables that reference any application user. The table *users* also contains the following information: e-mail, first name, last name, phone number, hashed password and user privileges.

The next table is called *employees*. It contains relevant information about the employees such as the ID, first name, last name and the most important list of supported services by the employee.

The table *activities* contains information about the provided services names and price for every provided service.

The table *dates* contains information about all scheduled appointments: date and time, the employee responsible for that appointment, the client that requested that appointment and information on whether the scheduled appointment is held.

Each employee has an individual table that contains the working dates and times for the whole year. This table contains records for the holidays, free days, working shifts layouts and vacation day layouts.

## 2.2 Advantages and disadvantages of the application

The main advantage of this application is the very simple use of the administrator's panel and the application's adaptability to the company services requested by the clients. The processes of publishing a web application on the web server and setting up application parameters are performed in several minutes. In order to adjust the application's parameters to the company's needs, the administrator has to insert services that the company offers and add employees and services they support into the database. After the working hours for each employee are set, clients are able to schedule appointments for the supported services through an interactive web form. The first testing prototype of the web application was for consulting services, but possible varieties of the application can be for a car workshop, spa centre or any similar small

enterprise. It is performed without any necessary programming skills and without changing the application's source code.

The application's main disadvantage is its realization to be universally applicable for companies that offer some services. Any other type of company or business would require a change in the application's source code. The first functional application's prototype does not have the notification functionality for the changes in the requested services scheduled terms or for the cancelling of services. This type of functionality could be achieved with sending e-mails or SMSs in the future web application's prototypes or versions.

## 3 APPLICATION'S PROFITABILITY

Today, the big entrepreneurs and enterprises are already expected to have the support of digital systems which help them in the business processes or even in the management of the whole enterprises. Such digital systems provide a large possibility for improvements and gaining an advantage over the competitors. Companies that partially or fully implement digital business solutions gain advantage over the companies that do not implement it. Information technologies require special training for employees and the return on invested capital is long-term and it is often difficult to accurately determine or predict it [8].

Consumers are used to web applications where they can get services or full access to the information they require in a matter of several mouse clicks, and they expect that the service industry and small enterprises already follow those trends. Consumers require Internet access services, an overview of the current and past activities and a possibility to change future services. If those expectations are not met on time, it opens up a space for someone to provide and take over a part or the entirety of a company's business. Digital systems that provide maximum profitability are the ones with intuitive management, full accessibility at any time and without errors. In addition to attracting a larger part of the market, this type of service gives companies better control over the activities and lowers the risk of the loss of opportunity cost due to an automatic management of appointments, and the consequence is that the company can offer more competitive prices.

Digitalization reduces the number of required documents in paper form, provides automatic determination of available free terms and their distribution, and it also accelerates the overall company performance.

Efficient use of the digitalization of business processes is reflected in the reduction of the manual data entry on paper, information is concentrated in one place and thus, there is a much better understanding of business costs and risks. Obtaining various pieces of information and statistics at the right time allows managers and company owners to get insight into the problems before it is too late and it gives them the possibility to correct the errors and guide their business towards the desired path. It is very difficult for large companies to reverse engineering and digitalize all their processes, which is why company management often

decides to completely change their processes by adapting them to digitalization. For small and medium-sized enterprises, this does not happen even though they have other problems related to the digitalization process.

In the example of a small company with the aim of reducing the opportunity cost when ordering and bringing closer its activities to as many consumers as possible, digitalization will open up new possibilities and provide numerous advantages. The automated scheduling of terms eliminates any opportunity for human error in booking, and at the same time it gives user the access to the agreed terms and any changes related to them. Scheduling the terms of services over the Internet is provided in the negligible trade service industry, and it is a safe way of getting a large number of new users. User access and the convergence of its work to a computer or mobile phone is a trend, and certainly will be the default way of doing business in the future of these companies.

In addition to the advantages in terms of getting new customers and a better business in this way, the digital system opens up numerous opportunities for the employees, management and owners of companies. Access to information in one place opens up opportunities for an easier evaluation of employees and jobs that the company deals with for the manager; and for employees, that insight builds confidence in the integrity and objectivity of such an evaluation. With the help of the obtained information, the employer may terminate activities that are visibly unprofitable or unused. An examination of the work of employees can result in moving employees to positions that suit them better or referring them to a better education about the activities they are weaker in.

In practice, SMEs in commercial establishments mostly have web shops (e.g. *zelda.hr*), but such systems do not have the application or the managerial control similar to the introduced system. The digitalization of systems that offer some services is very rare and it usually comes down to one web form that the company provides to see if there is any interest from the client side for the services, but all further scheduling of appointments is performed orally.

### 3.1 Application applicability in management control

Henry Fayol was among the first to define management control as something that consists of the monitoring of the overall performance according to the agreed plan, given commands and agreed principles to draw attention to errors in order to correct them and prevent their recurrence. The philosophy and application of managerial control were subjected to a constant and critical analysis [9]. Another definition of management control is that it is the process by which managers influence other members of the organization to implement the strategy of the organization [10].

The systems for management control are defined as systems that include mainly the accounting area of control and planning, the monitoring of activities, performance measurement and separate management control of the strategic and operating control. Such systems are described

more as a process of influencing behaviour. Systems for management control also represent a way to achieve the collective cooperation of individuals or organizational units that may not completely share their goals, but use this cooperation for their progress toward specific organizational goals [11].

The possibility of using these applications as a tool to aid management control allows access to information in one place. What we can get from the application is useful information on activities such as the frequency of the used services and the income rendered from those services. If the service is very rarely used, it is probably a good move to stop providing the service or to reduce the price of that service if the manager chooses to make such a decision. If they notice that the service has a sufficient number of terms but is still not profitable, the price of this service should be increased.

Apart from the information about services, this application can provide information about the work of employees. An overview of the services provided, the number of terms of services they have done and their income could be provided. From that information we can draw conclusions that are useful for management employees and their evaluation. Employees who provide certain services may be further educated in the field related to the provision of those services to clients, all in order to provide them to do their work the best they can or to give the employee some other task to do if he or she is better at it. If a certain service is used only once or twice, it might be a problem for an employee who provides it, and the customers will not come back to schedule new terms. If one of the services is very often used, but all clients choose the same employee to provide the service, it would be good to explore the mode of that employee and try to teach other employees to work in the same or similar manner. Some services could have a very large number of wanted terms and only a few employees with the expertise needed to provide this service, and the logical step would then be to educate current employees or recruit new experts to provide customers with those services. All of those changes would be easily incorporated into the system of the application considering its dynamic generation.

From these examples it is clear that this application can serve as a tool for management control, as part of the management control systems or the systems for the evaluation of employees.

## 4 CONCLUSION

This paper points to the functionality of the system for ordering in the service sector of small and medium enterprises which use ICT technology in the form of an application whose design is composed in a very simple way so that the person with the basic knowledge in the use of computers and the Internet can adapt the application to the needs of his/hers business.

The results of the paper can be easily implemented in practice, in the daily work of small and medium enterprises engaged in the service industry because the application is

easy to use and there is no need for any additional education of users. The aim is to organize work and make the application a part of the management control systems, evaluation and worker motivation.

The proposal for further research and work in this direction is to improve the system by issuing Internet accounts or to enable the use of the system by giving the customers via an SMS and e-mail the necessary information related to the requested service.

## 5 REFERENCES

- [1] Flanagan, D.: JavaScript - The definitive guide (6<sup>th</sup> ed.), O'Reilly Media, 2011.
- [2] Pouncey, I.; York, R.: Beginning CSS: Cascading Style Sheets for Web Design, Wiley / Wrox, 2011.
- [3] [http://www.w3schools.com/css/css\\_intro.asp](http://www.w3schools.com/css/css_intro.asp) (Accessed: 1 December 2016)
- [4] Nixon, R.: Learning PHP, MySQL, JavaScript, CSS & HTML5, Third Edition, O'Reilly Media, 2014.
- [5] [www.mysql.com](http://www.mysql.com), MySQL 5.7 Reference Manual, What is MySQL? (Accessed: 1 December 2016)
- [6] [www.mysql.com](http://www.mysql.com) - C.10.4 Limits on Table Column Count and Row Size – reference manual (Accessed: 1.12.2016)
- [7] <https://www.apachefriends.org/about.html> (Accessed: 1.12.2016)
- [8] Salo, J.; Alajoutsijarvi, K.; Karjaluo, H.: Digitalization and the Changing Structure of Business Networks, University of Oulu, 2003.
- [9] Fayol, H.: General and Industrial Management, Pitman Publishing, New York, 1949.
- [10] Newton, A. R.: The Management Control Function, Harvard Business School Press, Boston, 1970.
- [11] Langfield-Smith, K.: Management Control Systems and Strategy: A Critical Review, Monash University, Australia, 1997.

### Authors' contacts:

#### **Dominika CRNJAC MILIĆ, Associate Professor**

Josip Juraj Strossmayer University of Osijek  
Faculty of Electrical Engineering, Computer Science and Information  
Technology Osijek  
Kneza Trpimira 2B, 31000 Osijek, Croatia  
+385 31 224 681 / dominika.crnjac@etfos.hr

#### **Krešimir NENADIĆ, Associate Professor**

Josip Juraj Strossmayer University of Osijek  
Faculty of Electrical Engineering, Computer Science and Information  
Technology Osijek  
Kneza Trpimira 2B, 31000 Osijek, Croatia  
+385 31 495 429 / kresimir.nenadic@etfos.hr

APPENDIX

FERITOS Consulting

Registracija

a) Registration form

FERITOS Consulting

Upravljanje zaposlenicima
Dodavanje zaposlenika
Nazad
Odjava

Marko Bosnjak	Obriši zaposlenika	Pogledaj termine	Uredi aktivnosti	Postavi smjene
Petar Brahman	Obriši zaposlenika	Pogledaj termine	Uredi aktivnosti	Postavi smjene
Ivan Petrovic	Obriši zaposlenika	Pogledaj termine	Uredi aktivnosti	Postavi smjene
Nikola Berlin	Obriši zaposlenika	Pogledaj termine	Uredi aktivnosti	Postavi smjene
Steve London	Obriši zaposlenika	Pogledaj termine	Uredi aktivnosti	Postavi smjene
Bernam Angelo	Obriši zaposlenika	Pogledaj termine	Uredi aktivnosti	Postavi smjene

b) Employee management

FERITOS Consulting

Upravljanje aktivnostima
Dodavanje Aktivnosti
Nazad
Odjava

# FERITOS Consulting!

Donec id elit non mi porta gravida at eget metus. Fusce dapibus, tellus ac cursus commodo, tortor mauris condimentum nibh, ut fermentum massa justo sit amet . Use it as a starting point to create something more unique.

Learn more »

Postavi cijenu za aktivnost: **Web Consulting:**  Postavi

Aktivnost	Cijena		
Managment Consulting	200 kn	Promijeni cijenu	Obriši aktivnost
Web Consulting	210 kn	Promijeni cijenu	Obriši aktivnost
Startup Consulting	260 kn	Promijeni cijenu	Obriši aktivnost
Network Consulting	270 kn	Promijeni cijenu	Obriši aktivnost
E-Commerce Consulting	280 kn	Promijeni cijenu	Obriši aktivnost

c) Activity management

FERITOS Consulting		Upravljanje zaposlenicima	Dodavanje zaposlenika	Nazad	Odjava
Datum	Trenutna smjena	Postavi smjenu			
01-01-2017	<b>Nije postavljeno - neradni dan</b>	Ne radi	Prva smjena	Druga smjena	
02-01-2017	Prva smjena	Ne radi	Prva smjena	Druga smjena	
03-01-2017	Prva smjena	Ne radi	Prva smjena	Druga smjena	
04-01-2017	Prva smjena	Ne radi	Prva smjena	Druga smjena	
05-01-2017	Prva smjena	Ne radi	Prva smjena	Druga smjena	
06-01-2017	<b>Nije postavljeno - neradni dan</b>	Ne radi	Prva smjena	Druga smjena	
07-01-2017	Druga smjena	Ne radi	Prva smjena	Druga smjena	
08-01-2017	<b>Nije postavljeno - neradni dan</b>	Ne radi	Prva smjena	Druga smjena	
09-01-2017	Druga smjena	Ne radi	Prva smjena	Druga smjena	
10-01-2017	Druga smjena	Ne radi	Prva smjena	Druga smjena	
11-01-2017	Druga smjena	Ne radi	Prva smjena	Druga smjena	
12-01-2017	Druga smjena	Ne radi	Prva smjena	Druga smjena	
13-01-2017	Druga smjena	Ne radi	Prva smjena	Druga smjena	
14-01-2017	Druga smjena	Ne radi	Prva smjena	Druga smjena	
15-01-2017	<b>Nije postavljeno - neradni dan</b>	Ne radi	Prva smjena	Druga smjena	
16-01-2017	Prva smjena	Ne radi	Prva smjena	Druga smjena	
17-01-2017	Prva smjena	Ne radi	Prva smjena	Druga smjena	
18-01-2017	Prva smjena	Ne radi	Prva smjena	Druga smjena	

d) Work shift management

FERITOS Consulting		Dodavanje termina	Pregled termina	Odjava
<h1>FERITOS Consulting!</h1> <p>Donec id elit non mi porta gravida at eget metus. Fusce dapibus, tellus ac cursus commodo, tortor mauris condimentum nibh, ut fermentum massa justo sit amet . Use it as a starting point to create something more unique.</p> <p><a href="#">Learn more »</a></p>				
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <input type="text" value="Management Consulting"/> </div> <div style="width: 45%; text-align: right;">▼</div> </div>				
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <input type="text" value="Petar Brahman"/> </div> <div style="width: 45%; text-align: right;">▼</div> </div>				
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <input type="text" value="Siječanj"/> </div> <div style="width: 45%; text-align: right;">▼</div> </div>				
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <input type="text" value="16."/> </div> <div style="width: 45%; text-align: right;">▼</div> </div>				
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <input type="text" value="15h"/> </div> <div style="width: 45%; text-align: right;">▼</div> </div>				
<input type="button" value="Dogovorte Termin"/>				
<p>Uspješno ste dogovorili termin.</p>				

e) Scheduling an appointment

Figure 1 Some functionalities of the web application