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ONE POSSIBILITY TO AUTOMATE A TOURIST OFFER

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Abstract: *When the customer wants a product that fits their personal requirements, they are facing the challenge of whether to spend a huge amount of time and energy on choosing or configuring the desired product, or to settle for a predefined one. In the case of tourism packages, the customer can usually choose from predefined ones, or they can use numerous specialized web pages. This can often be rather time-consuming and annoying. Therefore, this paper presents an automated solution which generates a tourism package for a specific destination in just a few mouse clicks, accompanied with a case study.*

Key Words: ***Mass Customization, Personalization, Tourism Offer Automation***

1. INTRODUCTION

Customer focus has become a necessity in recent years because the product offer overload forced companies to fight for each individual customer. One result of this attempt is that companies now organize their activities around customers [1]. In order to address the individual needs of customers, mass customization has been introduced as an approach. One implication of this approach is that the variety and complexity of the product offers rises, both for the company and for the customer [2,3]. Mass customization changes the role of the customer from the consumer of a product to a partner in its creation [4]. Active customer participation is crucial for the successful incorporation of customer needs into the product, but it is also important to satisfy the user's experience-related requirements, because experience is created through a chain of human cognitive activities. Therefore, active customer participation is an important design driver for the whole process, which directly influences the final product offering [5,6,7].

To be able to incorporate the customer needs into the product, a system is needed that can translate the customer needs into product specifications, i.e., a specification system is necessary. Therefore, product configurators are used which translate customer needs into product designs in order to deliver a final solution based on product realization knowledge [8].

The involvement of the customer into the configuration of the final product raises several questions that have to be answered, one of which is that despite customers nowadays being knowledgeable in general, they are still far from being experts who can really co-create a product or a service [9]. The fundamental challenge is to avoid the abortion of the configuration process by the customer. In many cases, the customer aborts the configuration on his own due to a lack of customer-desired option values regarding a specific attribute within the system, as well as the inability of the customer to create definite preferences among certain option values. As a result, the customer does not reach the orders-sales phase. Furthermore, if customers are overwhelmed by the configuration task, there is a chance that they may abort the configuration process. Customers usually only want the product alternatives that meet their requirements perfectly; if too many choices are offered, customers can feel frustrated or confused, and therefore become incapable of making proper decisions.

Based on problem analysis regarding customers' involvement in the configuration process, the main areas of investigation to be considered are the minimization of the complexity experienced by the customers and the reduction of the cognitive overhead, considering not only the extent of choice, but the customer's lack of understanding of which solution meets their needs, and also the uncertainties about the behavior of the supplier and the purchasing process [10].

The fact that the number of IT users is steadily increasing, and that more and more people rely on the Internet to find information and solve their problems, suggests that the Internet is a suitable environment for providing customers with the appropriate products.

The results of analyzing available tourism services on the Internet yielded the conclusion that the offers of tourism packages are extensive (849000000 results on Google for *Tourism package* on June 27th 2012), i.e., there is a multitude of sites which will give practical information on how to organize a stay at desired locations with hotel packages, on-line booking, calendar of events, city maps, gastronomy, etc., but that they are far from being a personalized service to the customer [11].

The previously described aspects ask for the development of an on-line product configurator that can generate a personalized and automated tourism package offer in a short period of time, without much effort from the customer.

The remainder of the paper is structured as follows: First, a brief background is given on previously defined structure of the tourism package and customer profiling.

Following that, the algorithm developed for the tourism package configurator is presented, as well as the information technologies used for implementation of the product configurator. Next is a case study showing the test results of the developed configurator implemented in the wider area of Subotica, Serbia. Finally, a discussion of the results and conclusions are presented.

2. BACKGROUND

2.1. Defined structure of the tourism package

If one wants to configure a tourism package offer, the approach is to define this product as a complex object. Then, the package generation is made by combining a subset of components from a set of predefined ones, while meeting the customer requirements, and other predefined constraints.

The previously developed general product structure [12] is adapted to meet the requirements of the automated tourism package configurator. The adapted product structure is shown in Fig. 1.

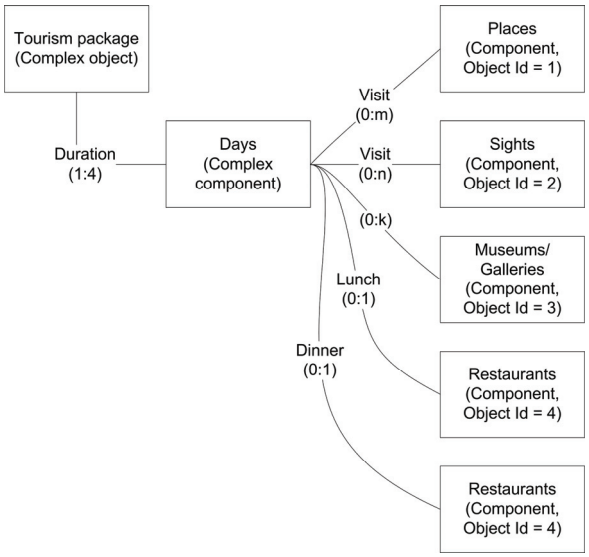

Fig. 1. *Adapted product structure*

The tourism package complex object consists of one or more 'day' objects, which are complex components as well. The range of the possible cardinalities for the duration of the tourism package is expressed by the interval (1:4), which means that the tourism package could last from one to four days. The 'day' complex component consists of four different type components. Components are places, sights, museums/galleries and restaurants. Cardinalities for 'lunch' and 'dinner' are 0 or 1, which means that there can be a restaurant component if the customer asks for it. Cardinalities for the other components range from 0 to *m, n* and *k*. 0 means that there is no component at all in the configured package, whereas *m, n* and *k* depend on constraints and requirements defined by the customer and by the developed configurator.

The structure of the components is defined as a hierarchical classification. The overall structure is previously defined [12]. At this time, for the purpose of this particular solution, only a part of the structure is used, which is shown in Fig. 2.

2.2 Customer profiling procedure

In order to be able to have an automated tourism package offer, the customer needs to be profiled first. Not only is an accurate customer profile needed, but the profiling process also has to be as quick and easy as possible, to make sure that the customer does not feel obliged to spend a considerable amount of time on this activity before a solution is offered.

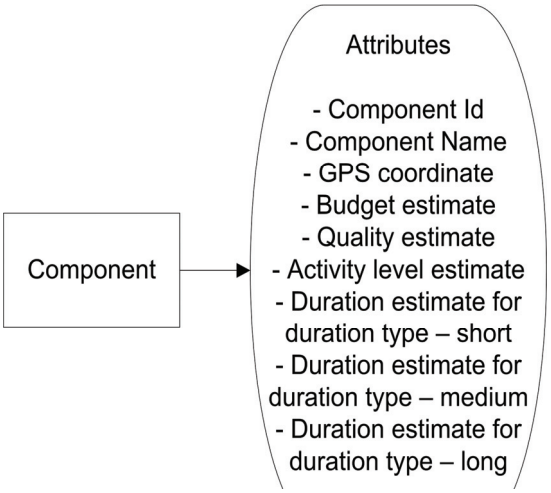

Fig. 2. Used component structure

For customer profiling, the previously developed two-level fuzzy reasoning general customer profiling algorithm is used, shown in Fig. 3 [11]. This way, the customer profile can be defined in a very short period of time, ideally by only two input variables (answers to questions). Some of the assumptions, on which the customer profile definition is based, are related to the following:

- Younger customers generally have small budgets, while middle-aged customers have the biggest one;
- As customers get older, their expectations rise, and they want to spend more time in one place. They also prefer lower activity levels;
- Families and bigger groups will probably visit fewer places, due to organizational difficulties, than couples or solo travelers.

All the inputs and the outputs from the fuzzy reasoning have an associated linguistic variable that can have values ranging from 0 to 1. The linguistic variables are:

- Age of the customer (Young, Mid, Old);
- Type of the customer (Single, Couple, Family, Friends);
- Budget (Low, Medium, High);
- Expectation (Low, Medium, High);
- Quality (Low, Medium, High);
- Level of activity (Low, Medium, High);
- Duration (Short, Medium, Long).

The $\mu(x)$ membership functions for all variables except for 'Type of the customer' are shown in equation 1. The membership functions for the variable 'Type of the customer' are shown in equation 2.

$$\mu_{Young,Low,Short}(x)=\begin{cases}1, & 0\le x\le 0.1\\ \dfrac{0.5-x}{0.5-0.1}, & 0.1<x\le 0.5\\ 0, & 0.5<x\le 1\end{cases}$$

$$\mu_{Mid,Medium}(x)=\begin{cases}0, & 0\le x\le 0.1\\ \dfrac{x-0.1}{0.5-0.1}, & 0.1\le x\le 0.5\\ \dfrac{0.9-x}{0.9-0.5}, & 0.5<x\le 0.9\\ 0, & 0.9<x\le 1\end{cases} \quad (1)$$

$$\mu_{Old,High,Long}(x)=\begin{cases}0, & 0\le x\le 0.5\\ \dfrac{x-0.5}{0.9-0.5}, & 0.5<x\le 0.9\\ 1, & 0.9<x\le 1\end{cases}$$

$$\mu_{Single}(x)=\begin{cases}0, & 0\\ \dfrac{x}{0.01}, & 0\le x\le 0.01\\ 1,, & 0.01<x\le 0.24\\ \dfrac{0.26-x}{0.26-0.24}, & 0.24<x\le 0.26\\ 0, & 0.26<x\le 1\end{cases}$$

$$\mu_{Couple}(x)=\begin{cases}0, & 0<x\le 0.24\\ \dfrac{x-0.24}{0.26-0.24}, & 0.24\le x\le 0.26\\ 1,, & 0.26<x\le 0.49\\ \dfrac{0.51-x}{0.51-0.49}, & 0.49<x\le 0.51\\ 0, & 0.51<x\le 1\end{cases}$$

$$\mu_{Family}(x)=\begin{cases}0, & 0<x\le 0.49\\ \dfrac{x-0.49}{0.51-0.49}, & 0.49\le x\le 0.51\\ 1,, & 0.51<x\le 0.74\\ \dfrac{0.76-x}{0.76-0.74}, & 0.74<x\le 0.76\\ 0, & 0.76<x\le 1\end{cases}$$

$$\mu_{Friends}(x)=\begin{cases}0, & 0<x\le 0.74\\ \dfrac{x-0.74}{0.76-0.74}, & 0.74\le x\le 0.76\\ 1,, & 0.76<x\le 0.99\\ \dfrac{1-x}{1-0.99}, & 0.99<x\le 1\\ 0, & 1\end{cases} \quad (2)$$

Table 1 summarizes the if-then rules used for the first level of fuzzy reasoning, while Table 2a and Table 2b summarize the rules used for the second level of reasoning.

If the output of the first level of fuzzy reasoning is not satisfactory for the customer, they can adjust that output, by changing the output values, which then serve as adjusted input into the second level of fuzzy reasoning. Whether or not the mid-level values are changed, they are analyzed by the second-level fuzzy logic. The output from this fuzzy reasoning is a set of constraints on the values of attributes of the components which form the tourism package. This two-level fuzzy reasoning is used to avoid the potentially conflicting values of the output that could occur if the customer enters values such as high expectations, but very low budget, etc.

Table 1. *If-then rules used for the first level of fuzzy reasoning*

Input to the first level of fuzzy reasoning		**Output from the first level of fuzzy reasoning**			
Age of the customer	**Type of the customer**	**Budget (L – Low, M – Medium, H – High)**	**Expectation L – Low, M – Medium, H – High)**	**Level of activity L – Low, M – Medium, H – High)**	**Duration S – Short, M – Medium, L – Long)**
Young	**Single**	L	L	H	M
	Couple	L	M	M	L
	Family	M	M	L	S
	Friends	L	L	H	L
Mid	**Single**	H	M	H	L
	Couple	H	H	H	M
	Family	M	M	M	S
	Friends	M	M	M	L
Old	**Single**	M	H	M	M
	Couple	M	H	L	M
	Family	M	H	L	S
	Friends	M	H	M	M

Table 2a. *If-then rules used for the second level of fuzzy reasoning*

Input to the second level of fuzzy reasoning		**Output from the second level of fuzzy reasoning**	
Budget	**Expectation**	**Budget (L – Low, M – Medium, H – High)**	**Quality (L – Low, M – Medium, H – High)**
Low	**Low**	L	L
	Medium	L	M
	High	M	M
Medium	**Low**	M	L
	Medium	M	M
	High	M	H
High	**Low**	M	M
	Medium	H	M
	High	H	H

3. DEVELOPED ALGORITHM AND TECHNOLOGIES USED FOR THE TOURISM PACKAGE CONFIGURATOR

3.1. Developed algorithm

The structure of the developed algorithm for the tourism package configurator is shown in Fig. 4. The first predefined process selects the places, sights and museums/galleries based on the input parameters

obtained from the customer, and data from the components' database. The selection is made by picking the components one by one, until the time frame is filled. The second predefined process is used for choosing the appropriate restaurants that serve as a basis for the inclusion of restaurants into the final itinerary. Restaurants are also selected based on the input parameters obtained from the customer, and data from the components' database. The number of chosen restaurants is larger than needed for the customer to be able to select the appropriate restaurants which are not too far away from selected components. After all components for the tourism package are defined, the package generator activates the final predefined procedure. This procedure optimizes the order of the components. As the result of the final procedure, the generated tourism package, i.e., the detailed itinerary is determined. It contains all the necessary data (sequences of events, durations, travel durations, etc). All procedures function in a way that one component can be selected only once.

Table 2b. *If-then rules used for the second level of fuzzy reasoning*

Input to the second level of fuzzy reasoning		**Output from the second level of fuzzy reasoning**	
Level of activity	**Duration**	**Level of activity L – Low, M – Medium, H – High)**	**Duration S – Short, M – Medium, L – Long)**
Low	**Short**	L	S
	Medium	L	M
	Long	M	M
Medium	**Short**	M	S
	Medium	M	M
	Long	M	L
High	**Short**	M	M
	Medium	L	M
	Long	L	L

3.2. Used information technologies for implementation

In order to be able to implement an on-line configurator for the automated tourism package, several information technology tools have to be used. The overview of the used technologies is presented in Fig. 5. PHP is used for data manipulation from the input and from the MySql database. The manipulated data is then transmitted to javascript. Javascript communicates with Google maps through Google maps API v3 to visualize the transmitted data to the map. In addition to mere visualization, there is a need for trip optimization. The used tool is Optimap [13]. The tool calculates the best possible roundtrip route and displays it on the map. During the restaurant insertion, the Haversine formula is used to make the decision, which restaurant to insert from the set of selected ones [14].

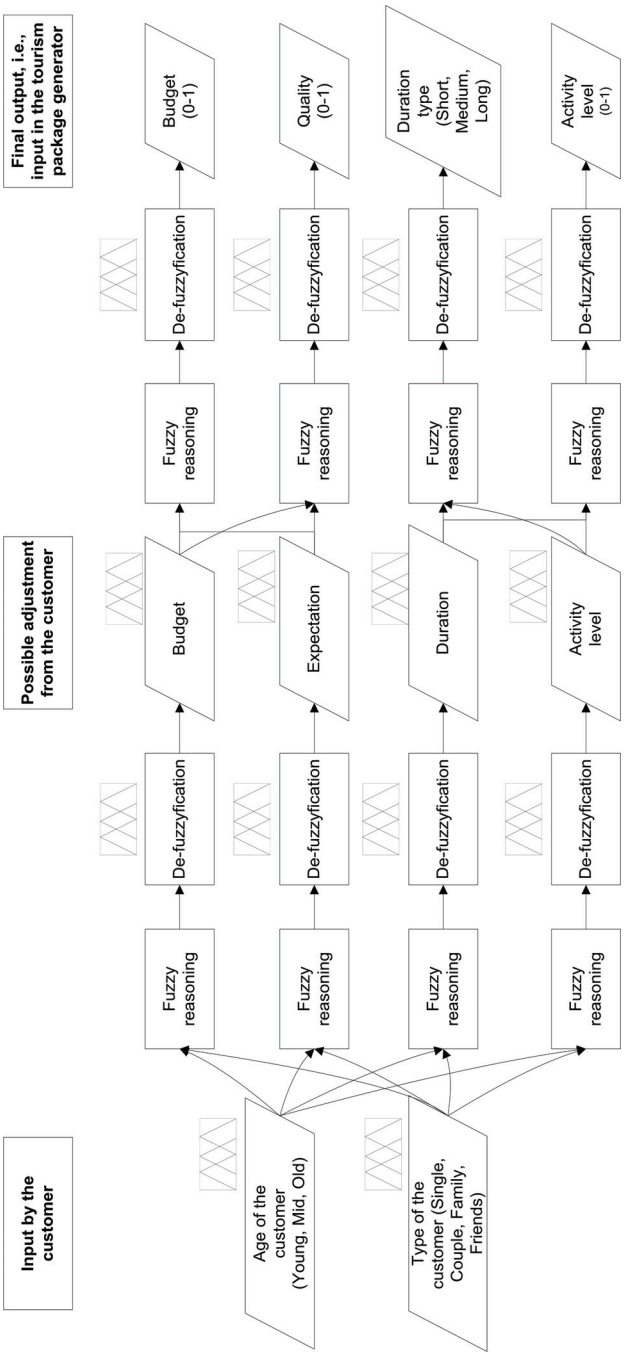

Fig. 3. *The fuzzy reasoning model*

4. CASE STUDY

The tourism package configurator is tested by configuring a package for the wider area of the city of Subotica, Serbia, to attain feedback on the developed approach. The case study tested three variations of input parameters that are presented in Table 3. The data whose values were varied are shaded. As an example, the visualization of input parameters for the 1st variation of input parameters is presented in Fig. 6. The output from the second-level of profiling for the input parameters is presented in Table 4. This output is not visible to the customer.

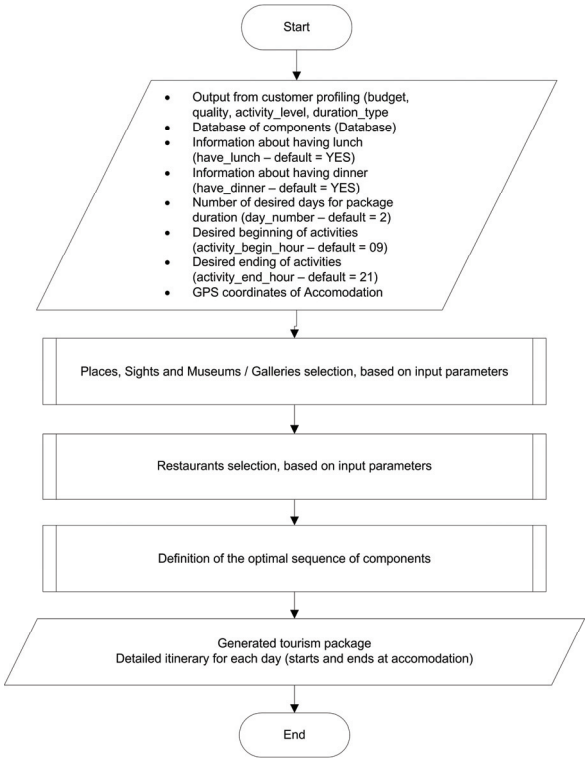

Fig. 4. *Tourism package generator*

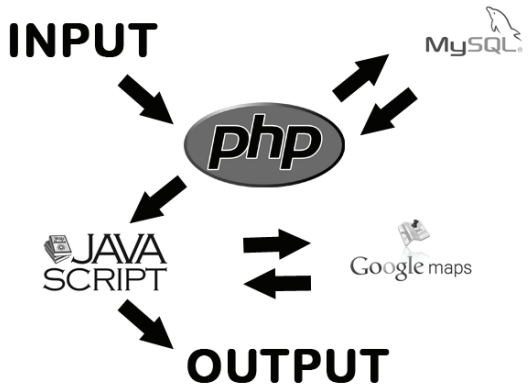

Fig. 5. *Used information technologies*

The component database currently consists of 79 records. 24 records are 'Places', which have attribute values for 'Budget' between 0.0 and 0.5, values for 'Quality' between 0.2 and 0.8, and for 'Activity level' between 0.2 and 0.9. 21 records are 'Sights', which have attribute values for 'Budget' between 0.1 and 0.9, values for 'Quality' between 0.2 and 0.8, and for 'Activity level' between 0.1 and 0.8. 12 records are 'Museums/Galleries', which have attribute values for 'Budget' between 0.1 and 0.7, values for 'Quality' between 0.3 and 0.9, and for 'Activity level' between 0.2 and 0.8. 22 records are 'Restaurants', which have attribute values for 'Budget' between 0.4 and 0.9, values for 'Quality' between 0.2 and 0.9, and for 'Activity level' between 0.1 and 0.3.

The selected components in the case of the 1st variation of input parameters are shown in Fig. 7, while the selected components in other cases are presented in Fig. 8 and Fig. 9 respectively.

Table 3. *Input parameters*

Input parameter	**1st var.**	**2nd var.**	**3rd var.**
Age of the customer [Y]	40	40	20
Type of the customer	Couple	Couple	Alone traveler
Budget	Auto. (0.58)	Auto. (0.58)	Auto. (0.17)
Expectation	Auto. (0.64)	Adapted (0.9)	Auto. (0.17)
Duration	Auto. (0.56)	Auto. (0.56)	Auto. (0.50)
Activity level	Auto. (0.64)	Auto. (0.64)	Auto. (0.83)
Have lunch	Yes	Yes	Yes
Have dinner	Yes	Yes	Yes
Begin activities [hour]	08:30	08:30	08:30
End activities [hour]	20:30	20:30	20:30
No. of days	2	2	2
GPS of accommodation	46.099067, 19.773417	46.099067, 19.773417	46.099067, 19.773417

As an example, the geographical locations of the selected components in case of the 2nd variation of input parameters are shown in Fig. 10. At this time, the presented components are neither optimized by day nor by order. Also at this time the restaurants are not included either. This output is not visible to the customer.

Also, as an example, the final automatic configuration, i.e., the configured itinerary in case of the 2nd variation of input parameters are shown in Fig. 11, Fig. 12, Fig. 13, and Fig. 14 respectively. The final configurations in other cases are not presented in the paper due to constraints regarding the length of the paper, but can be accessed on a test web page: http://tourismproject.vts.su.ac.rs/. The web page can be used only for testing purposes, and does not represent a solution that will be displayed to end users.

Table 4. *Output from the second-level of profiling for input parameters*

Output parameter	**1st var.**	**2nd var.**	**3rd var.**
Budget	0.56	0.82	0.28
Quality	0.56	0.82	0.26
Duration	Medium	Medium	Short
Activity level	0.52	0.52	0.50

5. DISCUSSION OF THE RESULTS

The results of tourism package configuration rely on the input parameters defined by the customer, on customer profiling, data from the database, and on rules defined by the predefined processes.

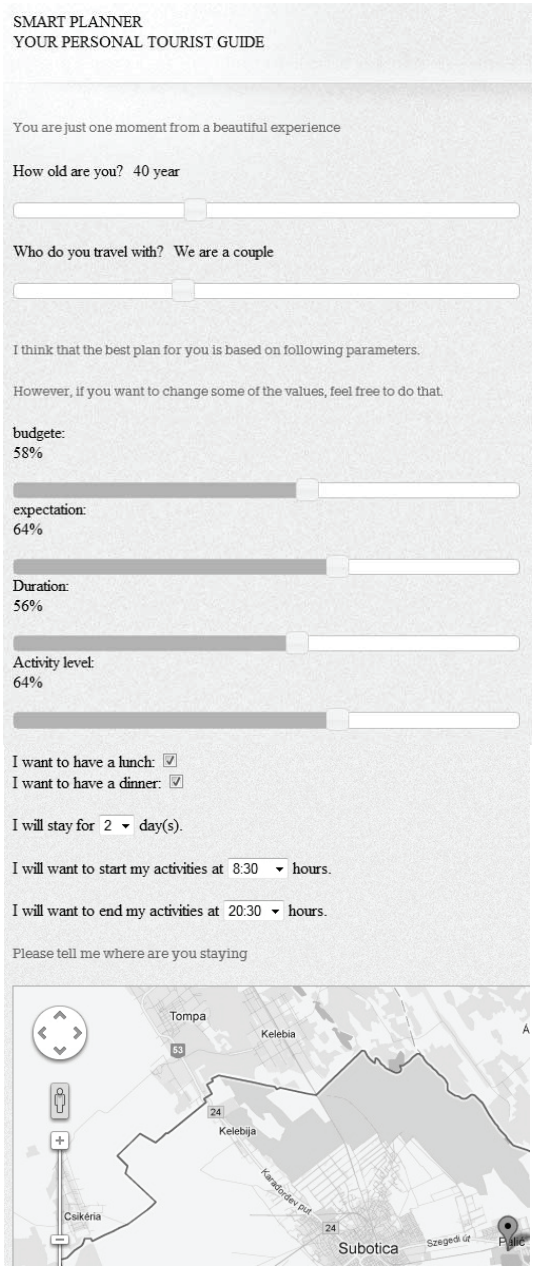

Fig. 6. *Visualization of input parameters*

Type	Name	Budget	Quality	Activity level	Duration
Places	Centar grada Subotica	0.5	0.6	0.2	1
Sights	Franjevacka crkva Subotica	0.5	0.6	0.1	0.5
Museums/Galleries	Toranj Senta	0.4	0.4	0.4	0.5
Places	Jevrejsko groblje Senta	0.4	0.6	0.4	0.75
Sights	Gradska kuca Kanjiza	0.5	0.6	0.3	1
Museums/Galleries	Muzej Zobnatica	0.7	0.3	0.5	1
Places	Strand Kanjiza	0.3	0.5	0.3	2
Sights	Pravoslavna Crkva Svetog Vaznesenja Subotica	0.4	0.6	0.1	0.5
Museums/Galleries	Gradski muzej Subotica	0.4	0.9	0.3	1
Places	Zoo Palic	0.2	0.7	0.3	2
Sights	Vinarija Tonkovic Backi Vinogradi	0.7	0.6	0.4	1
Museums/Galleries	Institut za kulturu Kanjiza	0.3	0.6	0.3	2
Restaurants	Denis Subotica	0.6	0.6	0.1	2
Restaurants	Alaska Hajdukovo	0.5	0.6	0.1	2
Restaurants	Nepker Subotica	0.6	0.5	0.1	2
Restaurants	Restoran Banja Kanjiza	0.5	0.6	0.1	1.5
Restaurants	Nirvana Subotica	0.5	0.5	0.1	2
Restaurants	Vinski Dvor Hajdukovo	0.6	0.6	0.2	2

Fig. 7. *Selected components in the case of 1st variation of input parameters*

Differences in customer profiling for the 1st and 2nd set of input parameters due to variation of the input parameter 'Expectation', results in differences regarding the chosen components (Fig. 7 and Fig. 8). 'Places' are more or less similar. This can be explained by the fact, that for 'Places', the attribute values in the database for 'Budget' are between 0.0 and 0.5, because of which, in spite of differences in customer profiling, similar components are chosen, as the predefined process in the first pass selects the components based on the attribute values for 'Budget'. However, other components differ to a greater extent because the attribute values for other component types are defined in wider ranges. The same result can be observed for the 3rd set of input parameters, but due to the output result for 'Duration' the number of selected components in this case is considerably higher than in the 1st and 2nd case. The results for restaurant selection show differences in each case, because the attribute values for restaurants are defined in wide ranges.

Type	Name	Budget	Quality	Activity level	Duration
Places	Centar grada Subotica	0.5	0.6	0.2	1
Sights	Vinarija Zvonko Bogdan Palic	0.9	0.7	0.4	2
Museums/Galleries	Spomen skola Senta	0.5	0.4	0.5	1
Places	Ergela Subotica	0.4	0.8	0.4	2
Sights	Vinarija Tonkovic Backi Vinogradi	0.7	0.6	0.4	1
Museums/Galleries	Gradski muzej Subotica	0.4	0.9	0.3	1
Places	Strand Kanjiza	0.3	0.5	0.3	2
Sights	Muhadzir Dzamija Subotica	0.6	0.5	0.4	0.5
Museums/Galleries	Toranj Senta	0.4	0.4	0.4	0.5
Restaurants	Galerija Subotica	0.8	0.8	0.1	2
Restaurants	Riblja Carda Palic	0.9	0.9	0.1	2.2
Restaurants	Gurinovic Subotica	0.9	0.7	0.1	2.2
Restaurants	Glorija Subotica	0.8	0.7	0.1	2
Restaurants	Mala Gostiona Palic	0.8	0.8	0.1	2
Restaurants	Restoran Zobnatica	0.8	0.7	0.2	1.6

Fig. 8. *Selected components in the case of 2nd variation of input parameters*

Type	Name	Budget	Quality	Activity level	Duration
Places	Groblje Kanjiza	0.2	0.3	0.4	0.5
Sights	Katolicka crkva Backa Topola	0.3	0.2	0.3	0.25
Museums/Galleries	Zeleznicka stanica Subotica	0.1	0.6	0.2	0.25
Places	Mlecna pijaca Subotica	0.2	0.5	0.3	0.5
Sights	Pijacni Trg Kanjiza	0.2	0.4	0.4	0.3
Museums/Galleries	Likovni susret Subotica	0.1	0.6	0.2	0.25
Places	Strand Kanjiza	0.3	0.5	0.3	1
Sights	Sencanska Crkva Subotica	0.3	0.5	0.1	0.25
Museums/Galleries	Institut za kulturu Kanjiza	0.3	0.6	0.3	1
Places	Pescana plaza Palic	0.4	0.3	0.7	0.5
Sights	Kerska Crkva Subotica	0.3	0.5	0.1	0.25
Museums/Galleries	Zeleznicka stanica Senta	0.1	0.7	0.2	0.5
Places	Istocno groblje Backa Topola	0.2	0.4	0.4	0.5
Sights	Gimnazija Senta	0.2	0.5	0.4	0.25
Museums/Galleries	Zeleznicka stanica Palic	0.1	0.8	0.2	0.25
Places	Staro groblje Kanjiza	0.1	0.4	0.4	0.3
Sights	Zeleznicka stanica Backa Topola	0.1	0.2	0.2	0.25
Museums/Galleries	Gimnazija Subotica	0.1	0.8	0.2	0.25
Places	Narodna basta Senta	0.1	0.6	0.2	1
Sights	Vidikovac Auto Put Supljak	0.1	0.2	0.2	0.25
Museums/Galleries	Galerija Vinko Percic Subotica	0.3	0.8	0.3	0.5
Places	Jevrejsko groblje Senta	0.4	0.6	0.4	0.5
Sights	Glavni trg Senta	0.1	0.4	0.3	0.5
Museums/Galleries	Toranj Senta	0.4	0.4	0.4	0.25
Places	Park Prozivka Subotica	0.1	0.6	0.5	0.5
Sights	Pravoslavna Crkva Svetog Vaznesenja Subotica	0.4	0.6	0.1	0.25
Museums/Galleries	Gradski muzej Subotica	0.4	0.9	0.3	0.5
Places	Jezero Backa Topola	0.1	0.6	0.7	1
Sights	Glavni Trg Backa Topola	0.2	0.3	0.4	0.3
Museums/Galleries	Muzej Zobnatica	0.7	0.3	0.5	0.5
Places	Obala Tise Kanjiza	0.1	0.6	0.8	1
Sights	Crkva Svete Terezije Subotica	0.4	0.7	0.1	0.5
Museums/Galleries	Spomen skola Senta	0.5	0.4	0.5	0.5
Places	Zoo Palic	0.2	0.7	0.3	1
Restaurants	Restoran Morrison Backa Topola	0.4	0.3	0.1	1
Restaurants	Pub Palic	0.4	0.4	0.1	1
Restaurants	Restoran Ceri Backa Topola	0.5	0.4	0.2	1
Restaurants	Nirvana Subotica	0.5	0.5	0.1	1
Restaurants	Restoran Banja Kanjiza	0.5	0.6	0.1	1
Restaurants	Jazz Caffe and Pizzeria Hajdukovo	0.4	0.2	0.2	1

Fig. 9. *Selected components in the case of 3rd variation of input parameters*

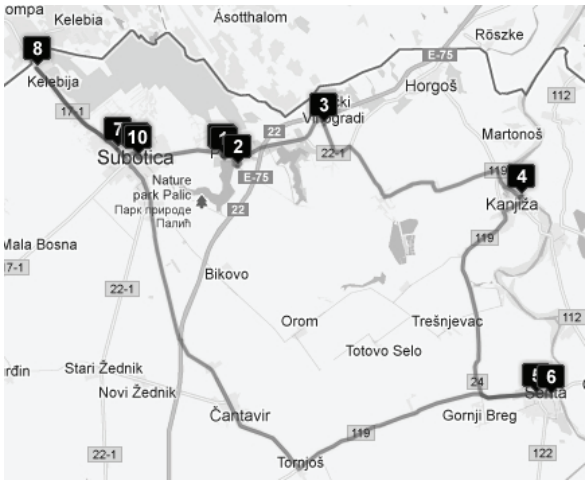

Fig. 10. *Geographical locations of the selected components prior to final optimization*

The insertion times of the restaurants for lunch are 14.25h for the first day and 12h for the second day (Fig. 11 and Fig. 13). Differences occur, because the predefined optimization process does not allow for lunch to start before 12.00h. Regarding dinner, this limit is set to 19.00, therefore the restaurants are inserted at 19.5h for the first day and at 19.2 for the second day.

The end of the activities is set to 20.5h (Fig. 6), but the configured itineraries are finished at 23.2h and at 21.45h (Fig. 11 and Fig. 13). Set time is only theoretical, because it occurs before the component selection, when the information about the duration of both the components and of traveling from one to another component is not known. Besides, travel durations times are rounded up to 15 minutes, and that can lead to significant prolongation of time, especially if the number of selected components rises. This problem could be reduced by rounding up travel times to the nearest five minutes.

Nm.	Name	Duration [h]	Start [h]	End [h]
1	start	0	8.5	8.5
	Trip:	0.25	8.5	8.75
2	Vinarija Zvonko Bogdan Palic	2	8.75	10.75
	Trip:	0.75	10.75	11.5
3	Strand Kanjiza	2	11.5	13.5
	Trip:	0.75	13.5	14.25
4	Mala Gostiona Palic	2	14.25	16.25
	Trip:	1	16.25	17.25
5	Spomen skola Senta	1	17.25	18.25
	Trip:	1.25	18.25	19.5
6	Riblja Carda Palic	2.2	19.5	21.7
	Trip:	0.25	21.7	21.95
7	Vinarija Tonkovic Backi Vinogradi	1	21.95	22.95
	Trip:	0.25	22.95	23.2

Fig. 11. *Itinerary of the final configuration for day one*

In the case of the itineraries, at first, it appears that the final configuration for day one is not optimized (Fig. 12). However, the presented itineraries are in fact the optimal solutions, keeping in mind the restrictions defined by the configurator. The problem lies in the fact, that the selected restaurants are located a bit far away from the components. This problem could be solved by defining a wider range of available restaurants in the area.

Fig. 12. *Sorted geographical locations of the final configuration for day one*

Nm.	Name	Duration [h]	Start [h]	End [h]
1	start	0	8.5	8.5
	Trip:	1	8.5	9.5
2	Toranj Senta	0.5	9.5	10
	Trip:	1.25	10	11.25
3	Muhadzir Dzamija Subotica	0.5	11.25	11.75
	Trip:	0.25	11.75	12
4	Gurinovic Subotica	2.2	12	14.2
	Trip:	0.25	14.2	14.45
5	Ergela Subotica	2	14.45	16.45
	Trip:	0.25	16.45	16.7
6	Gradski muzej Subotica	1	16.7	17.7
	Trip:	0.25	17.7	17.95
7	Centar grada Subotica	1	17.95	18.95
	Trip:	0.25	18.95	19.2
8	Galerija Subotica	2	19.2	21.2
	Trip:	0.25	21.2	21.45

Fig. 13. *Itinerary of the final configuration for day two*

Fig. 14. *Sorted geographical locations of the final configuration for day two*

6. CONCLUSION

The idea and need of being able to offer each customer a personalized tourism package, but without much effort and time spent by the customer on the configuration, resulted in the development of an on-line product configurator. The presented solution for the automated tourism package configurator is based on a previously developed product structure, and customer profiling procedure. The developed solution generates a detailed itinerary for each day of the package, based on inputs from the customer and procedures, which are developed for the configurator.

The developed configurator is tested on a case study for the wider area of the city of Subotica, Serbia, to attain the first feedback on the automated configuration results, which will serve as a guide for future development.

Based on configuration results, it can be concluded that, by defining a very small number of input parameters, a complete tourism package can be configured automatically. If the customer is satisfied with the profile defined after the first-level of profiling, and if they accept the default values of the package, the number of input parameters is only three. These are information about the age and type of the customer, and the location of accommodation.

The refined configurator is to be implemented into an overall internet service for tourism offerings of the area, to serve as a means to facilitate finding the appropriate tourism offer in a captivating, easy, and quick way. It is assumed that this way the interest of tourists in a given region will increase and that the increase of interest will lead to increased profits from tourism.

Certain issues arise from the fact that the presented configurator generates an automatic tourism package. One of the problematic points is that an automatic configuration does not take into consideration, whether the customers have specific requests regarding some tourist attractions or restaurants. Furthermore, customers do not have the opportunity to suggest new and adapt existing components, which could be used for new tourism package configurations. Also, at this time, there is no possibility for a feedback on customer profiling and on configuration results. In terms of directions for possible future research, this points towards the incorporation of the possibility for co-creation activities. These activities should be oriented primarily towards the involvement of customers in defining new and adapting existing components, by suggesting, grading, or voting. Also, feedback on customer profiling and on configuration results should be considered. This would likely turn this configurator into a comprehensive solution for tourism package offers.

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