

# Modeling an e-government portal and developing a system for tourism industry

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## ABSTRACT

Usability of the e-government portal is a crucial factor that should be considered for improving efficiency in services to citizens. In this study a heuristic design model is provided as a guideline in developing e-government portal. The quality of portals' usability lies on identifying user requirements and evaluation techniques. By studying user requirements and analyzing relevant factors for website usability, a new framework is proposed for tourism portal in Malaysia. The successful implementation and evaluation of portal provides useful contribution about modeling, analyzing and designing using UML with rational unified process. Besides, this paper proposes and designs a focus search engine. The result of this study can help to governmental companies to view the frameworks of existing websites to provide a convenient service for users.

## Keywords

Portal usability ; user interface ; e-government; Unified modeling language ; rational unified process ;website design

## INTRODUCTION AND BACKGROUND

The effectiveness of every government is characterized by better service to citizens and improved governmental process. Some governments try to do this by building portals to capture the content created by multiple government sources. Portals try to ease these by collecting content from different organizations into a single site according to clients' information needs.

Development an e-government portal for tourism industry requires a suitable user interface to interact with users. Regarding this issue, model-driven architecture (MDA) is a software design approach that provides certain guidelines for the structuring of information systems. (Jacobson et al. 1999; Rational 2001). The unified modeling language UML is known as most popular approach in MDA. In UML, a system is described using

different levels of abstraction and considering various views. Each view is realized using different UML modeling tools, such as use case diagrams, activity diagrams, sequence diagrams, collaboration diagrams, state chart diagrams, class diagrams, component diagrams, and deployment diagrams (Oestereich 1997; Rational 2001; Saleh 2002).

E-Government portal is potentially a powerful tool for administrative reform which enables the government to be client-oriented, transparent, accountable, effective and efficient. There are six functions in the e-Government Portals addressed by Zhou (2004). These six functions are: E-filing, E-payment, download files, Searchable consultative information for individuals or businesses, Subscription / registration service, E-mail service.

The scope of this paper is tourism industry in Malaysia and designing a portal to improve the government-citizen's relation efficiency. On the other hand, designing a search engine to remove non-related page from retrieved pages in web is essential. Using current search engines compel users to remove non-related pages that is too time consuming and sometimes impossible. A focus search engine automated this disambiguation process.

Most governmental websites tend to follow design guidelines of commercial websites despite the fact that the two kinds of websites have different characteristics and consumers stated by Wang, Bretschneider and Gant (2005). For increasing the effectiveness of portals , designing a suitable website with appropriate user interface is needed.

The main purpose of e-government portal is to interact with citizens to increase social participants. Nowadays, there are many guidelines for designing governmental portals that none of them satisfy users completely. Users face too many difficulties to interact with text, graphics and so on in web pages. In e-Government Portal context, many people expect many things such as

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services and information from current e-Government platforms. The design guideline should consider what is needed by the website. One of the aspects of e-government that is crucial for citizens is tourism. Tourists are keen on interacting with government to retrieve needed information from government.

In addition, designing a search engine that filter and categorize information efficiently is proposed. Therefore; a focus search engine of Malaysian tourism for foreigner is designed.

## METHODOLOGY

For this paper, multi-methodological approach has been chosen as a research methodology. Multi-methodological is the first constructive methodology addressed by Nunamaker *et al* in 1991. This approach is selected because it is Easy to be implemented in any development project and it is Easy to use and understand. Software development involves a number of steps to be carried out, so that a software system is properly modeled, analyzed, designed, specified and implemented. For E-tourism portal we use URL and follow with RUP.

First of all, a framework for development of e-tourism portal is designed. It based on the heuristic design model that has been proposed. All the requirements and specifications have been specified to propose the design model and final design guideline will be made. Secondly, The sketch of interface will be based on analysis outcomes. Then a proposed prototype will demonstrate the proposed heuristic design model. For testing efficiently and user friendliness of system a questionnaire is distributed among the users to get feed back of system.

Existing Design Guidelines in Web Design based on Interaction Style and Design Element are assessed. The current e-government portal is used of MAMPU (Malaysian Administrative Modernization and Management Planning Unit) guideline. For this reason, non functional and functional criteria are assessed and 6 design models compared together. These design model guidelines are Low-context Web design, Website Usability Guideline, Web Content Accessibility Guidelines, myGovernment Portal Guideline by MAMPU, Ten Usability Heuristic and Levi and Frederick (2008). The criteria of these guidelines assessed are Images, Advertisement, Process (testing and planning), Real world presence, Error, Audience

Awareness, Technical Problem, and Alternative to auditory and visual content, Natural Language and Use chunking in non function aspect. And Animation, Content, Navigation, Visibility system status, User control and freedom, Consistent and standard, Recognition rather than recall, Flexibility, Aesthetic design, Help user recognize, diagnose, and recover from error (error message) and Help & documentation in function aspect. By this comparison it is concluded that the guideline that has been provided by MAMPU is not detail enough for the web designer in order to guide them during system design phase.

By studying current Johor Tourism Portal these limitations are identified: Lack of website navigation, e-brochure is hard to access, lack of photo gallery, lack of search ability, a lot of broken links, lack of highlighting and structuring important information and content and lack of user feedback.

Factor analysis is a collection of methods to reduce number of Variables to a few factors but principal component analysis is different from factor analysis. Both analysis reduce the variables with different methods. In other word, principal factor analysis starts extracting the maximum variance and puts them into the first factor. After that, it removes that variance explained by the first factors and then starts extracting maximum variance for the second factor. This process goes to the last factor. Eigen value show variances that explained by a particular factor. That is the first factor explains the percentage of variance out of the total variance.

In this research the question of the research is: Which factors should be considered to increase the user satisfaction in users' point of view?

For user requirement a questionnaire has been distributed among a group of 330 people. For selecting the number of sample simple sampling method with proportion probability is used, number of 35 people chosen as a first sample and 30 persons answered the questions. This initial sample determines  $p_y$  that is 86%. The list number of persons that should be selected comes out the following equation. In this formula is the statistical population that is obtained from Johor tourism portal and is equal to 998081.

From the following formula the number of sample is determined that is equal to 330

$$n \geq \frac{9N p_y (1 - p_y)}{(N - 1)(0.0667)^2 p_y^2 + p_y (1 - p_y)}$$

This questionnaire is designed based most famous usability heuristics proposed by Jakob Nielson.

Based on the result of this study, firstly principle component analysis is used for variables that presented in the designed questionnaire o remove variables with low variance and low correlation.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy test show that sample size is acceptable because the value is close enough to one. The chi square test shows that there is a significant difference between the groups that is depicted in table

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.818
Bartlett's Test of Sphericity	Approx. Chi-Square
	2.661E3
	df
	378
	Sig.
	.000

**Table 1. KMO and Bartlett's Test**

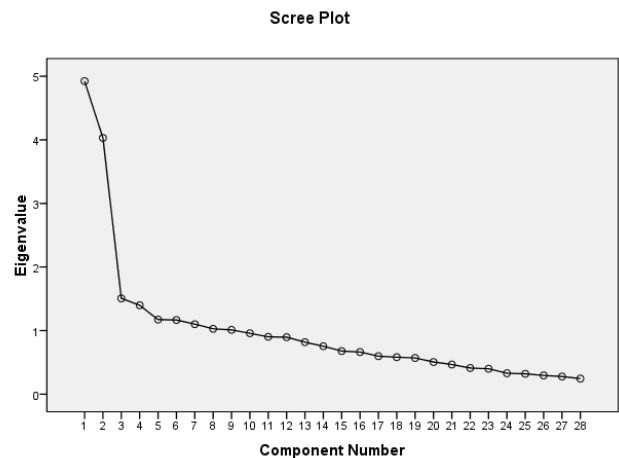
Total variance explained table show that 9 components are required to put into consideration as showed in Table 2 and all of 9 components which are selected have the eigen values greater than one . The cumulative extraction sums of square loading are 61.916 % of total variances.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.923	17.583	17.583	4.923	17.583	17.583
2	4.030	14.394	31.977	4.030	14.394	31.977
3	1.507	5.381	37.358	1.507	5.381	37.358
4	1.398	4.994	42.353	1.398	4.994	42.353
5	1.172	4.187	46.540	1.172	4.187	46.540
6	1.167	4.167	50.706	1.167	4.167	50.706
7	1.100	3.930	54.637	1.100	3.930	54.637
8	1.028	3.671	58.308	1.028	3.671	58.308
9	1.010	3.609	61.916	1.010	3.609	61.916
10	.958	3.421	65.338			
11	.901	3.219	68.557			
12	.896	3.199	71.756			
13	.817	2.919	74.676			
14	.754	2.692	77.368			

15	.678	2.422	79.790		
16	.662	2.365	82.155		
17	.598	2.135	84.290		
18	.582	2.078	86.369		
19	.569	2.033	88.402		
20	.506	1.807	90.209		
21	.467	1.666	91.876		
22	.411	1.466	93.342		
23	.400	1.427	94.769		
24	.329	1.175	95.944		
25	.320	1.142	97.085		
26	.295	1.053	98.138		
27	.277	.990	99.128		
28	.244	.872	100.000		

**Table2 Total variance explained**

Screen lot that is depicted in figure 1 shows that the first 9 component eigen values are greater than one and from 10<sup>th</sup> component the line is flat that is each successive component is accounting for smaller and smaller than amounts of total value.



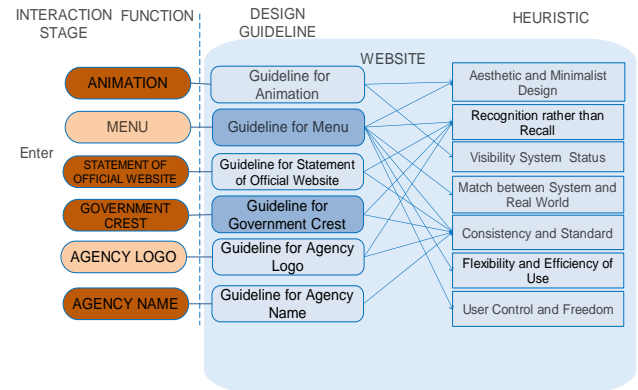
**Figure 1. Scree plot**

From the following table 9 components extracted from 28 variables by largest eigen values and largest percentage of total variance.

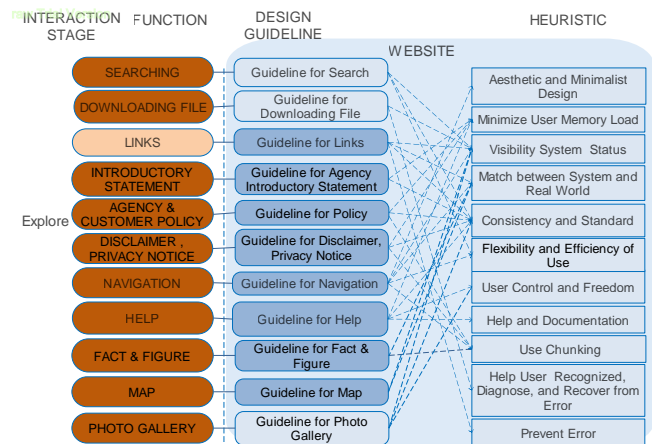
Component	Extraction
Icon used in portal should not sensitive with the culture.	0.722
Meaningful groups of items must be separated by white space.	0.709
The data display should start in the upper-left corner of the screen.	0.703
Icons used in portal should relevant to its function and familiar to user.	0.696
The icons must easily recognizable.	0.681
Icon used in portal should not sensitive with the culture.	0.678
The error messages should be display in a plain and understandable language and suggest a solution.	0.677
There is an ?undo? function in data entry.	0.673
Each page must be labeled to show its relation to others.	0.673

**Table2. selected components**

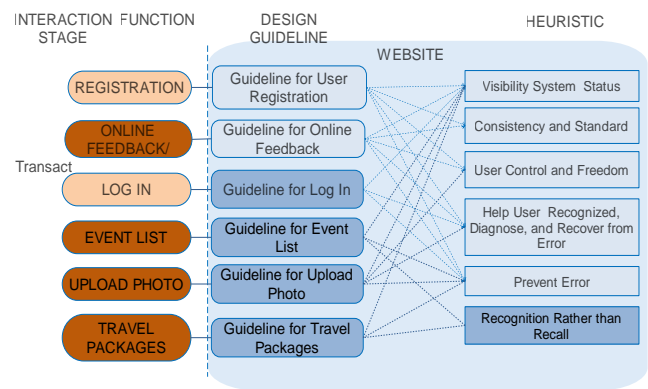
**Revised Framework - Enter Stage:** After analysis of user requirements, the proposed heuristic is been revised based on the user requirements. After indentified functions and its interaction style, the design guideline and its principle been matched. It is based on the items in the questionnaire that been analyze in data analysis. In the questionnaire, there are 11 heuristic principles with a list of guideline that related with the principle. Every principle has its design guideline. The design guideline is based on the interaction style and design element. Every function is made from several design elements and interaction style. From here, the author found the relation between function, interaction style and design element, design guideline and heuristic and applied in the proposed heuristic design model. Figure 2, 3 and 4 shows the proposed framework based on three interaction stages which are enter stage, explore stage and transact stage which are proposed by Doa Bamasoud



**Figure 2 : Revised Framework - Enter Stage**



**Figure 3 : Revised Framework – Explore Stage**



**Figure 4: Revised Framework – Transact Stage**

Figure 5 depicts use case diagram of the proposed application

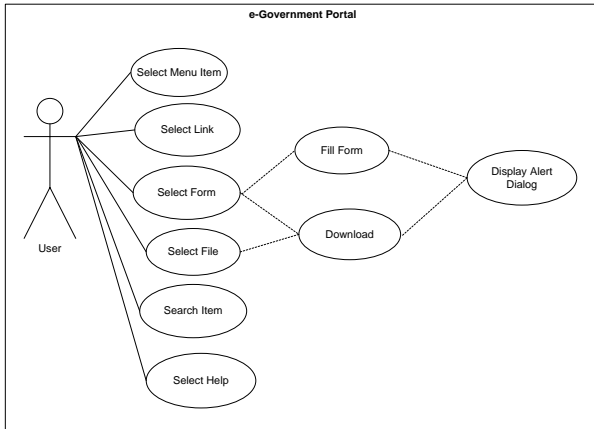


Figure 5. Use Case Diagram of The Proposed Application

Table 3 shows a brief description of use case diagram (Doa Bamasoud)

	the available file. In the alert dialog, it has an error message.
Search Item	The user uses this use case for item and information searching.
Select Help	The user uses this use case to select help document in the portal.

Table3 ., description of use case diagram

Figure 6 shows the class diagram for the proposed model (Doa Bamasoud)

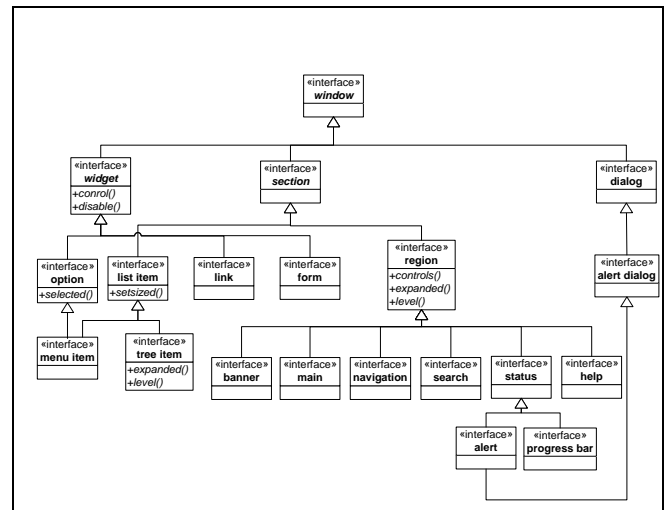


Figure 6. Class diagram

Use Case Name	Description
Select Menu Item	The user uses this use case to select the menu item usually at the top of the page in the portal. This use case enables the user to go to the other section in the portal.
Select Link	The user uses this use case to select the link in the page of the portal. The link usually at the main section in the page.
Select Form	The user uses this use case to select the form that available in the portal.
Select File	The user uses this use case to select the file that want to be download or to be review. The file is available in .doc or PDF format.
Download	The user uses this use case to download the file or form.
Fill Form	The user uses this use case to fill the form after select the form. In this context, the forms are registration form, feedback or enquiry form and log in form.
Display Alert Dialog	The user uses this case when display alert dialog after fill in the form or download

## IMPLEMENTATION

From the proposed heuristic design model, a prototype of Johor Tourism Portal has been build. The system has three interaction stages which are enter, explore and transact stages. Besides, a search engine designed based user requirements is designed to satisfy users' need in each stage different features of portal regarding to guidelines heuristic that want to achieve are changed . in figure 7 website navigation is depicted in explore stage as an example. Similarly, other parts are changed .

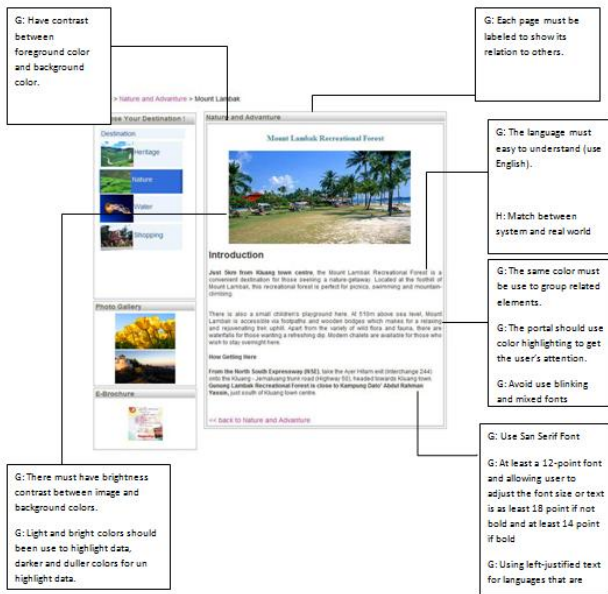


Figure 7. website navigation design

. Every interaction stages has several functions with the specific design guideline to achieve the principle. G represents design guideline and H is heuristic that want to achieve. Based guidelines and desired heuristic different part of current system is revised. For explore stage not only the interface is changed, but also the architecture of search system changed completely because of user requirements. The architecture of focus search engine is depicted in figure 8

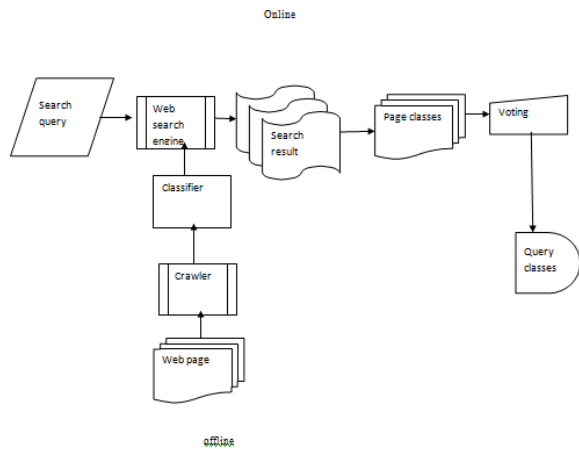


Figure 8. architecture of website search engine

The following components, frameworks and applications are utilized for implementing search engine in tourism portal:

**Spring framework:** is an open source application framework for Java platform. The version used is 3.0.2. The core features of the Spring Framework can be used by any Java application. There are extensions for building web applications on top of the JAVA EE platform. The spring framework is used because it supports DI and IOC concepts.

**Maven:** is a software tool for Java project management and build automation. Maven uses a construct known as a *Project Object Model (POM)* to describe the software project being built.

**Apache tomcat:** is an open source servlet container developed by the Apache Software Foundation (ASF). In this system is used for showing interface.

**log4j logging framework (version 1.2.9):** In case of problems with an application, it is helpful to enable logging so that the problem can be located. With log4j it is possible to enable logging at runtime without modifying the application binary. The log4j package is designed so that log statements can remain in shipped code without incurring a high performance cost. To debug a misbehaving configuration use the Java VM Property `-Dlog4j.debug` which will output to standard out.

**Apache Lucene** is a high-performance; full-featured text search engine library written entirely in Java.in this system standard lucence is used.

In search engine by calling core, system start to index and the results will be inserted in to repository. Core module is always resident and the process of searching is hieratical.

**EVALUATION**

For ensuring about meting the objectives system should be evaluated for measuring the effectiveness of system and detection of errors. Evaluation process is divided into three parts: black box test, integration test and user acceptance test. In black box test all the units are tested by a top-down approach. Integration test verifies that one application works with others. For user acceptance test, the sample is a group of 30 peoples. Explanation about the testing is given to the sample. They will be navigate the prototype system and have to answer the user acceptance test form based on their experienced in navigate the system. The questionnaire is based on heuristic described before. Table 4 shows the result of user acceptance test

Heuristic		Mean	Percentage (%)
H1	Visibility of System Status	3.83	76.67
H2	Match between System and the Real World	4.22	84.44
H3	User Control and Freedom	4.26	86.00
H4	Consistency and Standard	4.11	82.22
H6	Error Prevention	4.00	80.00
H6	Recognition Rather than Recall	4.17	83.33
H7	Flexibility and efficiency to use	4.00	80.00
H8	Aesthetic and Minimalist Design	3.76	76.00
H9	Help and Documentation	4.17	83.33
H10	Help user recognize, diagnose, and recover from error	3.67	73.40
H11	Use Chunking	4.00	80.00

**Table 4. Results of User Acceptance Test**

From the developers' perspective, an evaluation has been carried out, two developers who actually developed the proposed system and 6 independent developer asked to imply their opinion about this system. This trial has been based on four criteria namely appropriateness, preciseness, expressiveness, and analyzability. A scale from 1 to 5 chose. All the criteria get the marks between 3 to 5. And developers think the RUP and UML used for the system meet the objectives and criteria.

### CONCLUSION

This paper focus on designing an e-government portal and focus search engine according to UML-based URP life cycle approach and propos a heuristic design model for tourism portal function to increase the usability of system . more over, this system provide a focus search engine , this paper propose a Semantic Web framework that eases the

deployment of semantic search engines in Malaysian tourism industry. From the analytical result, this study finds out that the users of tourism e-government websites think..... The proposed heuristic design model can achieve at least 70% of heuristic. Improvement of the framework can be done in future studies such as catering the requirement of e-Government For example, the services and functions in e-Government Portal. It can be done by interviewing with the government stakeholders and also from observation of e-Government Portal.

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