Measurement of Problem Difficulty Level in User Interface Medical Management System (MMS) Application with Heuristic Evaluation Approach at Surabaya Medical Services Hospital

Amir Ali[1], Muhadi[1], M. Udin Harun Al Rasyid[2] and Iwan Syarif[2]

[1]Departement of Medical Record and Information Technology, Stikes Yayasan Rumah Sakit Dr.Soetomo, Kalidami, Surabaya, Indonesia
[2]Department of Informatics and Computer Engineering, Politeknik Elektronika Negeri Surabaya (PENS), Raya ITS Keputih Sukolilo, Surabaya, Indonesia

Abstract: Surabaya medical service hospital has a Hospital Management Information System (SIMRS) application called the Medical Management System (MMS). However, the level of difficulty of the problem on the user interface has not been measured from SIMRS application. The user interface can be examined by using an inspection approach, one of which is heuristic evaluation to determine the system's level of usability. The problem can be rated according to its difficulty level by using severity ratings. This research is to measure the level of difficulty of the user interface SIMRS MMS Surabaya Medical Service Hospital uses a heuristic evaluation approach. The method used in this study was in form of distribute questionnaires to the research object under investigation and apply the severity ratings methodology to calculate the findings of the heuristic evaluation. According to the usability test with heuristic evaluation, the most serious usability issues are in the areas of recognition rather than recall; help users recognize, diagnose, and solve problems with a severity rating of 6.75, while the lowest score is in the areas of help users recognize, diagnose, and recover from errors with a severity rating of 1. According to the results of the heuristic evaluation of the SIMRS MMS application, it has usability issues with an average value of 2.42 on a scale of 2 which means the category of minor usability problems where fixing this problem is given low priority.

1 INTRODUCTION

Sistem Informasi Rumah Sakit (SIRS) has become necessity for hospital facilities. In line with the Regulation of the Minister of Health (PERMENKES) RI Number 1171/MENKES/PER/VI/2011 (Permenkes, 2011) concerning Hospital Information System or (SIRS) stated that: "Every hospital is obliged to carry out SIRS as a process of collecting, processing, and presenting hospital data.

In relation to government's regulation, Surabaya Medical Service Hospital has been running an *Informasion Management Rumah Sakit* (SIMRS) application called Medical Management System (MMS). This SIMRS application, however, has not been measured against the difficulty of problems in the user interface to determine how easy users of the SIMRS application find it to use.

The user interface an application can be evaluated using an inspection method, one of which employs heuristic evaluation to determine the level of usability of the system (Sulistiyono, 2017). Moreover, usability concerns in SIMRS MMS applications can be identified via heuristic evaluation. By using severity ratings, the problem can be assessed based on its level of difficulty (Ito, Yoshihiro. Nomura, 2013).

2 METHOD

In this study, the research population was users of SIMRS MMS application with 10 users from the registration counter, medical records, outpatient service registration place or *Tempat Pendaftaran Pelayanan Rawat Jalan* (TPPRJ), inpatient service registration place or *Tempat Pendaftaran Pelayanan Rawat Inap* (TPPRI), pharmacy, laboratory, billing system.

The research variables used in this study are:

a. Visibility of System Status
b. Match between system and the real word
c. User Control and Freedom
d. Consistency and Standard
e. Error Prevention
f. Recognition rather than recall
g. Flexibility and Efficient of Use
h. Aesthetic and Minimalist Design
i. Help Users Recognize, dialogue and recovers from errors
j. Help and documentation

By using heuristic evaluation, usability issues in SIMRS MMS applications can be identified. The problem can be assessed according to the level of difficulty of the problem (Severity Ratings).

2.1 Research Variable and Measurement

The research variables, operational definitions, and methods for measuring them are listed below

Table 1: Research Variables and Measurement.

Variable Inspection	Variable Definition	How to Measure
(*Visibility of System Status*)	The system should give information to the user about everything happen through the right feedback in the right time.	The severity rating on usability problems is determined by a scale 0 to 4. 1. Scale 0 : No usability problem 2. Scale 1: Cosmic problem category 3. Scale 2: Minor usability category. 4.Scale 3 Major usability category 5. Scale 4: catastrophe usability category
Match between system and the real word	The system must use the user language with words, phrases, and concepts that the user understands rather than the language that the system understands. Furthermore, always adhere to current trends and arrange	Severity rating level on usability issue is determined on a scale of 0 to 4. 1. Scale 0: No usability problem 2. Scale 1: Cosmic problem category
	information in a natural and orderly manner.	3. Scale 2: Minor usability category.
User Control and Freedom	Users frequently make mistakes when selecting functions or buttons in the system, whether on purpose or unintentionally. In this state, they require a clear exit sign to exit the unwanted screen without having to begin or read a series of instructions. As a result, undo and redo functions are required.	4.Scale 3 Major usability category 5. Scale 4: catastrophe usability category
Consistency and Standard	The user should not be confused; otherwise, different words, situations, and actions will have the same meaning. It should be noted that in the system, all navigation must be consistent.	Severity rating level on usability issue is determined on a scale of 0 to 4. 1. Scale 0: No usability problem 2. Scale 1: Cosmic problem category 3. Scale 2: Minor usability category. 4.Scale 3 Major usability category 5. Scale 4: catastrophe usability category
Error Prevention	What is preferable to displaying an error message is to create a good system design that can anticipate the appearance of problems in the system's early stages. Also, before the user proceeds with the action, provide confirmation options.	Severity rating level on usability issue is determined on a scale of 0 to 4. 1. Scale 0: No usability problem 2. Scale 1: Cosmic problem category 3. Scale 2: Minor usability category. 4.Scale 3 Major usability category 5. Scale 4: catastrophe usability category

Table 1: Research Variables and Measurement (cont.).

Variable Inspection	Variable Definition	How to Measure
Recognition rather than recall	Make objects, actions, and choices clear so that users don't have to remember the same information in different sections. Instructions for using the system should also be easily accessible whenever the user requires them.	Severity rating level on usability issue is determined on a scale of 0 to 4. 1. Scale 0: No usability problem 2. Scale 1: Cosmic problem category 3. Scale 2: Minor usability category. 4.Scale 3 Major usability category 5. Scale 4: catastrophe usability category
Flexibility and Efficient of Use	Accelerators, which are often overlooked by new users, can speed up interaction for existing users. That is what the system should be able to accomplish. What should be considered is that the system must provide functions that both experienced and novice users can understand.	Severity rating level on usability issue is determined on a scale of 0 to 4. 1. Scale 0: No usability problem 2. Scale 1: Cosmic problem category 3. Scale 2: Minor usability category. 4.Scale 3 Major usability category 5. Scale 4: catastrophe usability category
Aesthetic and Minimalist Design	Dialogues should not include information that is irrelevant or only occasionally required. More specific information in a dialog should be adapted to the unit.	Severity rating level on usability issue is determined on a scale of 0 to 4. 1. Scale 0: No usability problem 2. Scale 1: Cosmic problem category 3. Scale 2: Minor usability category. 4.Scale 3 Major usability category 5. Scale 4: catastrophe usability category
Help users recognize, dialogue and recovers from errors	Error messages should be explained in clear language (not coded) that clearly	Severity rating level on usability issue is determined on a scale of 0 to 4.

	indicate the error and suggest solutions.	1. Scale 0: No usability problem 2. Scale 1: Cosmic problem category 3. Scale 2: Minor usability category. 4.Scale 3 Major usability category 5. Scale 4: catastrophe usability category
Help and Documentation	Although it is preferable if the system can be used without documentation, help and documentation may be required. Each piece of information should be easily accessible, relevant to the user's task, provide concrete steps of workmanship, and not be overly lengthy.	Severity rating level on usability issue is determined on a scale of 0 to 4. 1. Scale 0: No usability problem 2. Scale 1: Cosmic problem category 3. Scale 2: Minor usability category. 4.Scale 3 Major usability category 5. Scale 4: catastrophe usability category

2.2 Heuristic Evaluation Aspect and sub aspect

Heuristic evaluation value was obtained by doing calculations based on the following heuristic evaluation aspect table (Farida, Dwi, 2016)

Table 2: Heuristic Evaluation Aspect.

Usability Aspect	Kode
Visibility of the system status	H1
Compatibility between the system and the reality	H2
User control and freedom	H3
Consistency and standardize	H4
Error prevention	H5
Help users identify, diagnose and resolve problems	H6
Flexibility and Efficiency	H7
Minimalist and aesthetic design	H8
Assist users in recognizing, conversing about, and correcting errors.	H9
Documentation and help feature	H10

The average results of each attribute in each aspect / principle of heuristic evaluation above were used to calculate questionnaire results.

Calculations on heuristic evaluation using equations (1):

$$\sum Hx = 0 * x + 1 * x + 2 * x + 3 * x + 4 * x \,... \quad (1)$$

$\sum Hx =$ Number of rating scores from sub aspects of usability in each aspect of usability (H1, H2, …, H10)

$x =$ usability points (valued at 1/0)

Then, using equation (2), generate a severity rating value for each aspect of usability:

$$Sv = \sum \frac{Hx}{n} \quad (2)$$

Sv = Severity rating has an effect on one aspect of usability

n = the number of usability sub-aspects in each usability aspect

The severity level of a usability problem can be determined using the following scale of 0 to 4

a. Scale 0: There are no usability issues.
b. Scale 1: Cosmetic problem; problem does not need to be fixed unless there is time remaining in the project.
c. Scale 2: Category minor usability issue, resolve this issue given a low ranking
d. Scale 3: Category major usability issue, resolve this issue given top priority.
e. Scale 4: Category usability disaster; this issue must be resolved prior to the product's release

Here is a list of heuristic evaluation aspects and sub-aspects of heuristic evaluation

Table 3: Usability Aspect and sub aspects.

Aspect	Sub Aspect Usability
Visibility of the system status	1. Each page has a title that describes the page's content. 2. Each symbol or icon, as well as the design scheme, on each page is consistent. 3. There is a visually distinguishing response when an object (button, option button) is pressed or selected. 4. The menu and page names correspond to the content.
	5. The display menu can already distinguish between the currently selected menu and those that are not.
Compatibility between the system and the reality	1. Icons that can be used by anyone 2. The menu name is written logically and is understood by the user. 3. The shape or image used is appropriate for the user's culture. 4. For users who are actively using the app, there is a language option.
User control and freedom	1. There is a help button if the system does not display the results of any process, such as if an error occurs. 2. Users have the ability to search for data in a variety of ways. 3. If the system has a nested menu, the user should be able to easily navigate to the previous page.
Consistency and standardize	1. Each page is labeled with a title. 2. Each page has consistently written standard writing. 3. Each page's title is consistent in terms of font shape, size, and paragraph length. 4. The appearance of the form on the web for each page is consistent and the same. 5. Other commonly spoken languages are available as language options. 6. Not only images can be displayed, but there are also accessibility standards for users on each page, which is especially important for those with special needs (blind people, deaf people)
Error prevention	1. The text provided is in clear instructions and avoids ambiguity 2. All information has been properly organized. 3. Each page contains navigation instructions for the user.
Help users identify, diagnose and resolve problems.	1. When it is unable to access the page, an error message appears. 2. When a user makes a mistake when making changes, a warning sign appears.
Flexibility and Efficiency	1. The application page displays content in the language selected by the user. 2. Menus and other information are presented in an attractive manner. 3. Group menus and other information are simple to recall. 4. On each page, there is a navigation menu that can assist us. 5. The Navigation Menu is in the proper location. 6. The search menu is simple to find and use.

Table 3: Usability Aspect and sub aspects (cont.).

Aspect	Sub Aspect Usability
Minimalist and aesthetic design	1. There is a variety of foreign languages available to accommodate users from other countries. 2. The search menu is simple to remember and use, especially for inexperienced users. 3. The menu's layout is very familiar and easily accessible to the user. 4. The system allows you to change the size of the letters. 5. There is no color selection as a system action code.
Assist users in recognizing, conversing about, and correcting errors	1. The information displayed on each page is clear, allowing the user to make subsequent decisions. 2. The use of appropriate font sizes and types on each page makes visitors feel at ease. 3. Each page's structure is consistent and uniform. 4. Each page's title is clear and informative. 5. There are no irrelevant characteristics.
Documentation and help feature	1. There is a menu map, so users can easily see what is available. 2. There is a help menu that can assist users in navigating the site more effectively. 3. There is contact information/ correspondent information from the page's owner.

3 RESULT AND DISCUSSION

3.1 Result

The display page of SIMRS MMS application was evaluated as shown below:

Figure 1: Interface Page Display Cashier Registration Menu.

Figure 2: Pharmaceutical Interface Page Views.

Figure 3: Laboratory Interface Page View.

Figure 4: Master Menu Interface Page View.

The following are the results of the usability aspects calculation using the heuristic evaluation method:

Table 4: Calculation of Usability Aspects and Sub Aspects of Usability 1.

Aspect Usability	Sub Aspect Usability	SR					Total SR	Score SR
		0	1	2	3	4		
A	B	C	D	E	F	G	I	J
1	1	7	1	0	0	2	9	1,8
	2	7	2	0	0	1	6	1,2
	3	8	0	1	1	0	5	1
	4	7	2	0	1	0	5	1
	5	8	1	0	1	0	4	0,8
		37	6	1	3	3		5,8
		0	6	2	9	12	1	1,16

Description: SR (Severity Rating)

The calculation for heuristic evaluation is shown in Table 4. The value of the heuristic evaluation is

represented by the list of severity rating values in the C,D,E,F,G column. Column I is a column that contains the number of severity ratings obtained by adding the severity rating values together. According to the equation (1) that

$$I = (0*C1)+(1*D1)+(2*E1)+(3*F1)+(4*G1)$$

Furthermore, in column J, the severity rating value obtained is $J = I/5$, where 5 is the number of usability sub-aspects in table 3.

Table 5: Calculation of Usability Aspects and Sub Aspects of Usability 2.

Aspect Usability	Sub Aspect Usability	SR					Total SR	Score SR
		0	1	2	3	4		
A	B	C	D	E	F	G	I	J
2	1	5	3	0	0	2	11	2,75
	2	9	0	0	0	1	4	1
	3	7	2	1	0	0	4	1
	4	6	2	1	0	1	8	2
		27	7	2	0	4		6,75
		0	7	4	0	16	2	1,69

Description: SR (Severity Rating)

Table 6: Calculation of Usability Aspects and Sub Aspects of Usability 3.

Aspect Usability	Sub Aspect Usability	SR					Total SR	Score SR
		0	1	2	3	4		
A	B	C	D	E	F	G	I	J
3	1	3	1	2	0	4	21	7
	2	6	1	1	1	1	10	3,33
	3	7	1	0	1	1	8	2,67
		16	3	3	2	6		13,00
		0	3	6	6	24	4	4,33

Description: SR (Severity Rating)

Table 7: Calculation of Usability Aspects and Sub Aspects of Usability 4.

Aspect Usability	Sub Aspect Usability	SR					Total SR	Score SR
		0	1	2	3	4		
A	B	C	D	E	F	G	I	J
4	1	7	0	2	0	1	8	1,33
	2	8	0	1	0	1	6	1
	3	8	0	2	0	0	4	0,67
	4	8	0	1	0	1	6	1,00
	5	5	1	3	0	1	11	1,83
	6	6	2	1	0	1	8	1,33
		42	3	10	0	5		7,17
		0	3	20	0	20	1	1,19

Description: SR (Severity Rating)

Table 8: Calculation of Usability Aspects and Sub Aspects of Usability 5.

Aspect Usability	Sub Aspect Usability	SR					Total SR	Score SR
		0	1	2	3	4		
A	B	C	D	E	F	G	I	J
5	1	6	1	0	0	3	13	4,33
	2	7	2	1	0	0	4	1,33
	3	6	2	1	1	0	7	2,33
		19	5	2	1	3		8,00
		0	5	4	3	12	3	2,67

Description: SR (Severity Rating)

Table 9: Calculation of Usability Aspects and Sub Aspects of Usability 6.

Aspect Usability	Sub Aspect Usability	SR					Total SR	Score SR
		0	1	2	3	4		
A	B	C	D	E	F	G	I	J
6	1	5	1	0	1	3	16	8
	2	5	2	1	1	1	11	5,5
		10	3	1	2	4		13,5
		0	3	2	6	16	7	6,75

Description: SR (Severity Rating)

Table 10: Calculation of Usability Aspects and Sub Aspects of Usability 7.

Aspect Usability	Sub Aspect Usability	SR					Total SR	Score SR
		0	1	2	3	4		
A	B	C	D	E	F	G	I	J
7	1	7	2	0	0	1	6	1,00
	2	6	1	1	2	0	9	1,50
	3	8	0	1	1	0	5	0,83
	4	6	3	0	0	1	7	1,17
	5	8	0	1	0	1	6	1,00
	6	6	3	0	0	1	7	1,17
		41	9	3	3	4		6,67
		0	9	6	9	16	1	1,11

Description: SR (Severity Rating)

Table 11: Calculation of Usability Aspects and Sub Aspects of Usability 8.

Aspect Usability	Sub Aspect Usability	SR					Total SR	Score SR
		0	1	2	3	4		
A	B	C	D	E	F	G	I	J
8	1	4	3	2	0	1	11	2,2
	2	8	0	1	0	1	6	1,2
	3	7	1	1	0	1	7	1,4
	4	7	1	2	0	0	5	1
	5	3	2	3	1	1	15	3
		29	7	9	1	4		8,8
		0	7	18	3	16	2	1,76

Description: SR (Severity Rating)

Table 12: Calculation of Usability Aspects and Sub Aspects of Usability 9.

Aspect Usability	Sub aspect Usability	SR					Total SR	Score SR
		0	1	2	3	4		
A	B	C	D	E	F	G	I	J
9	1	7	1	1	0	1	7	1,4
	2	7	1	2	0	0	5	1
	3	7	2	1	0	0	4	0,8
	4	8	1	0	1	0	4	0,8
	5	7	1	2	0	0	5	1
		36	6	6	1	1		5
		0	6	12	3	4	1	1

Description: SR (Severity Rating)

Table 13: Calculation of Usability Aspects and Sub Aspects of Usability 10.

Aspect Usability	Sub Aspect Usability	SR					Total SR	Score SR
		0	1	2	3	4		
A	B	C	D	E	F	G	I	J
10	1	5	2	1	1	1	11	3,67
	2	6	2	1	1	0	7	2,33
	3	7	1	2	0	0	5	1,67
		18	5	4	2	1		7,67
		0	5	8	6	4	3	2,56

Description: SR (Severity Rating)

Table 14: Severity Rating Recapitulation In SIMRS MMS Application.

Usability Aspect	Average Value Of Severity Rating	Rounding Value Scale 0-4
1	1,16	1
2	1,69	2
3	4,33	4
4	1,19	1
5	2,67	3
6	6,75	7
7	1,11	1
8	1,76	2
9	1	1
10	2,56	3
Rounding Value Scale 0-4	2,42	2

3.2 Discussion

The distribution of questionnaires against the research objects investigated, as well as the calculation of heuristic evaluation findings using severity ratings approaches, were the methods used in this study.

The following are the steps of the methods used in this study:

1. Problem Identification
2. Literature of the study
3. Arrangement and Distribution of Questionnaire
4. Data collection
5. Usability measurement using heuristic evaluation of SIMRS MMS
6. The result of heuristic evaluation Analysis

To calculate the difficulty level of the problem in the SIMRS SMS application user interface using the inspection method with a heuristic evaluation approach, the following equation is used in the calculation of the value of the questionnaire evaluation results:

Heuristic evaluation calculations using equation (1):

$$\sum Hx = 0 * x + 1 * x + 2 * x + 3 * x + 4 * x \ldots \quad (3)$$

$\sum Hx$ = Number of rating scores from sub aspects of usability in each aspect of usability (H1, H2, …, H10)

x = usability points (valued at 1/0)

Furthermore, using equation (2), calculate the severity rating value for each usability aspect:

$$Sv = \sum \frac{Hx}{n} \quad (4)$$

Sv = Severity rating has an effect on one aspect of usability

n = the number of usability sub-aspects in each usability

4 CONCLUSIONS

The following conclusions are drawn from the results of the SIMRS MMS application usability test:

1. Based on usability test with heuristic evaluation, the biggest usability problem is in the aspect of recognition rather than recall; help users to recognize, diagnose and solve problems with a severity rating value of 6.75 while the lowest value is in the Help users recognize, diagnose and recover from error aspect; Help users identify, diagnose, and recover from errors with a severity rating of 1.

2. It received a value of 2 in the 7th aspect of the heuristic evaluation technique, namely flexibility and efficiency where the menu and other information sub-aspects are well packaged, indicating that it is necessary to prioritize improvements from that side for SIMRS MMS applications.

3. The overall average value of all usability aspects is 2.42 or a scale of 2, indicating that this problem categorized into minor usability problems, with repair given low priority

REFERENCES

Farida, Dwi, L. (2016). Pengukuran user experience dengan pendekatan usability (studi kasus: website pariwisata di asia tenggara). *Seminar Nasional Teknologi Informasi Dan Multimedia 2016*.

Ito, Yoshihiro. Nomura, Y. (2013). Evaluation of Influence of IP QoS Degradation on Web-QoE by Severity Rating Method. *Asia-Pacific Conference on Communications (APCC)*.

Permenkes, M. (2011). *Permenkes RI Tentang SIMRS*.

Sulistiyono, M. (2017). Evaluasi heuristic sistem informasi pelaporan kerusakan laboratorium universitas amikom yogyakarta. *Jurnal Ilmiah DASI, 18*.