USABILITY-BASED MEDICAL INFORMATION SYSTEM PROTOTYPE USES A GOAL-DIRECTED DESIGN TO IMPROVE PATIENT ACCESS TO HOSPITAL SERVICES

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Abstract

The results of preliminary research on the use of a medical website of a hospital showed a usability value of 2.3 out of a scale of 4, which means that the quality of the website's services is not satisfactory, so patients are reluctant to use medical portal services. Even though the hospital patient service portal is an essential medium after the Covid-19 pandemic, it can be used to increase pasiesn access to hospitals by not knowing the time. The non-stop operation of the portal can help patients get the information and services that patients need anytime and anywhere. . However, not all services can satisfy customers or patients. The behavior of the people of the "New Normal" era who must still pay attention to distance, and changes in consumer behavior who are always looking for convenience through the internet, cause hospitals to be able to manage portals which can meet the needs of hospital consumers. Unfortunately, medical information portals are still managed with no regard for patient information needs. The biggest challenge in this study is achieving the hospital's goal of providing superior services for patients by paying attention to medical information needs. patients. Therefore , this research seeks to improve website services by redesigning *the website* as a prototype using The design approach of a prototype *Goal Directed Design* (GDD) of a *website* can be known for its *usability* value. The end of the study showed that the increase in the usability test results was based on the average value of all usability factors of 3.69 from the original condition of 2.3 or an increase in the usability value of 60%.
Keywords*: Goal Directed Design*, Hospital, *Prototype*,. *Website*, Healthcare

INTRODUCTION

Providing the best service for patients is one of the main factors that become the benchmark of institutions engaged in medical services. An indicator of good service is satisfaction with the average of all services having an above-average performance value[1][2]. In the digital era, the existence of a health service portal in the form of a *website* is a demand that two-way communication can occur even without interaction with officers for 24 hours. Especially in the conditions of an outbreak such as during the Covid-19 pandemic, the need for hospital health services has increased. On the other hand, people are asked to limit mobility, especially since hospitals are considered precarious places in transmitting the Covid-19 disease. Therefore, hospitals consider it essential to improve *the website* interface so that patients and prospective patients get health care information before visiting the hospital. Efforts can be made to improve the interface by conducting *usability testing*. *Usability testing* is usability testing that measures based on ease of learning, efficient in use, easy to remember and able to interact without any difficulty [3]

Based on quantitative testing through *usability testing* [4][5] involving 75 respondents, namely hospital employees and the community around the hospital by distributing questionnaires, the results obtained that the *website* The hospital

has a learnability value of 2.49, *efficiency* of 2.02,   *memorability* of 2.60, *errors*) of 1.87 and *satisfaction* of 2.09. These values can be concluded that the average of all variables in usability *testing* is 2.30 on a scale of 4, so it can be interpreted that *the website* is not so   good used by users because they still have difficulty getting the desired information service. Complementing the quantitative test is also carried out qualitative tests through interviews with the general public and hospital patients. The interview results are first, the features are not complete, because there are no online registration features, *telemedicine* and health articles. Second, the flow of *the website* is still unclear. All three pieces of information are difficult to obtain. Finally, the appearance of the *website* is less attractive.

The problem, which has been measured by 2.3 out of a scale of 4 usability values, is included in the below-average category, so it can be said that service users are not satisfied with services that given. With these conditions , it is necessary to adjust website services by redesigning the *website* by paying attention to the conditions of *the usability* evaluation that has been carried out. The output of website redesign is a   medical service *website* prototype   using the   *Goal Directed Design* (GDD) approach[6]. The GDD approach was taken because this design stage had a focus on the user to unite   different goals developed by Alan Cooper [7][8] This GDD provides a solution that meet the needs of users. GDD is also centered on achieving organizational goals. GDD relies on the observation that users rarely use the system so it offers stages to determine the needs and context of the person using the system So that in the design of a new system based on what the user expects is not the subjective opinion of the system designer [9].

The use of GDD design stages by Yudhistira Maulana [10] shows an increase in *usability* values above the average. However, some indicators are still below the indicators perfect, namely related to *Acceptability range*, *Grade scale*, and *Adjective rating*. The same result was carried out by Tresnamayu Rahma Dika [11] with the GDD approach having significant differences that show that the value of all indicators that are priority for improvement is met .

METHOD

Efforts were made to increase the *usability* value of 2.3 from a scale of 4 on the hospital *website* , a redesign process was carried out using the GDD method. Furthermore, after the prototype is produced, usability *testing* is carried out to determine the improvement of website services based on usability   indicators, including *learnability* (easy to learn),   *efficiency*,   *memorability* , *errors* and *satisfaction* . The design process with GDD that is carried out includes several stages, namely *research*, *modeling*, *requirement* definition, *framework definition* , *refinement* and *support*.

This process is carried out by collecting preliminary data that can be done with interviews and observations [9]. At the *research* stage, literature studies, interviews and observations are carried out and preliminary evaluations are conducted.   This study's literature study is *Goal Directed Design* and *usability testing* for reference to evaluate, analyze and design interfaces. The interview was conducted with five samples: the director of PT, the director of the hospital, and three patients.   This interview is used to obtain data related to problems during services, the condition of the *existing website* and the future expectations of patients. The results obtained are that existing features need development, a less attractive appearance, need to improve the website's flow and *user interface*.

The next step is to conduct an initial evaluation by distributing questionnaires to *website* users. The evaluation was carried out using *usability testing* with five components, namely *learnability*, *efficiency*, *memorability*, *errors* , *satisfaction* and questionnaire measurement techniques using a likert scale with a rating level with a scale of 1 (strongly disagree) - 4 (strongly agree). 75 respondents participated in filling out this questionnaire. After obtaining the results of the questionnaire, validity tests and reliability tests are carried out. Validity test is used to test the accuracy or correctness of an instrument while reliability is a test that has an orientation to stability, consistency, power Prediction and accuracy [12].

At the *modeling* stage, the creation of a user *persona* from *a website* user is carried out in which there is an overview of user behavior, user goals and user interaction. *A user persona* is a user model that focuses on the user's goals when using a system [13]. *User personas* are essential for product development because they can help communicate user needs efficiently and can help strategize and make design decisions that bright [14].

At this stage focuses on the users who have been specified in the previous stage. *Requirement definition* is done by creating user scenarios, *user journeys*, and flow systems . The steps performed at this stage are based on user needs so that users can more easily get the desired health service and help the interface design process Later it becomes more accessible because it has been analyzed. The result of this phase balances between the user, business and technical needs of the design

The interaction framework analysis process is carried out in this phase using visual tools. These visual tools can be *wireframes* with reference scenarios and user needs defined in the previous stage. *Wireframe* was the initial framework before *the website* interface was designed [15]. *Wireframe* defines the layout structure and functionality of a product and *wireframes* are created before doing visual or hi-fi design [16].

At the refinement stage, a prototype is made. Prototype is a design solution for problems and concepts in website building [17]. The prototype is made by determining each user interface component's visual appearance in terms of colors, icons and so on.

At the *support* stage, a final evaluation is carried out on the prototype design. The final evaluation was done by distributing questionnaires using *usability testing* and involving respondents, namely website users.

RESULTS AND DISCUSSION

Based on the results of observations and data collection carried out at a hospital , namely Randegansari Husada Hospital Surabaya as a place to conduct research produced from several stages in GDD as follows:

3.1. Research

Initial evaluation uses *usability testing* using five components, namely *learnability*(L), *efficiency*(E), *memorability*(M), *errors*(R) and *satisfaction*(S).

Table 1. Initial Evaluation of *Learnability* Indicators

Indicators	Response				Mean
	STS (1)	TS (2)	S (3)	SS (4)	
L1	4	13	39	19	2.97
L2	7	8	37	23	3.01
L3	34	23	10	8	1.89
L4	7	33	25	10	2.51

L5	29	20	17	9	2.08
Average					2.49

Table 1 shows that the *learnability* indicator gets an average value of 2.49 on a scale of 4. This means that the existing *website* is still complex for patients to learn.

Table 2. Initial Evaluation of *Efficiency Indicators*

Indicators	Response				Mean
	STS (1)	TS (2)	S (3)	SS (4)	
E1	34	20	12	9	1.95
E2	31	22	11	11	2.03
E3	24	31	10	10	2.08
Average					2.02

Table 2 shows that the *efficiency* indicator gets an average value of 2.02 on a scale of 4. This means that the existing *website* is still not efficient to use.

Table 3. Preliminary Evaluation of *Memorability* Indicators

Indicators	Response				Mean
	STS (1)	TS (2)	S (3)	SS (4)	
M1	4	30	27	14	2.60
M2	8	31	27	9	2.49
M3	6	27	30	12	2.64
Average					2.58

Table 3 shows that the *memorability* indicator gets an average value of 2.58 on a scale of 4. This means that the existing website is still not easy to remember how to use and the symbols used on the *website.*

Table 4. Initial Evaluation of *Indicator Errors*

Indicators	Response				Mean
	STS (1)	TS (2)	S (3)	SS (4)	
R1	41	12	13	9	1.87
Average					1.87

Table 4 shows that the *errors* indicator gets an average value of 1.87 on a scale of 4 . This means that the existing *website* still does not notify when something undesirable happens, such as giving a warning when you have to fill in your personal data first before sending it.

Table 5. Initial Evaluation of *Satisfaction Indicators*

Indicators	Response				Mean
	STS (1)	TS (2)	S (3)	SS (4)	
S1	23	30	9	13	2.16
S2	33	22	11	9	1.95
S3	24	18	11	12	2.15
Average					2.09

Table 5 shows that *the satisfaction* indicator gets an average value of 2.09 on a scale of 4. This means that the existing *website* still does not satisfy patients.

User persona was obtained from interviews and observations with several respondents to be used as a reference to design the user interface to suit *user* needs. *User personas* are grouped into two, namely patients and medical personnel.

Kebutuhan

Ingin adanya pendaftaran online, ingin dapat berkonsultasi tanpa harus datang ke rumah sakit, mengetahui jadwal pelayanan dan dokter, mengetahui layanan apa saja yang ada pada rumah sakit

Tujuan

ingin selalu merasa dekat dan selalu terhubung dengan rumah sakit agar ketika dibutuhkan tidak perlu datang pada rumah sakit

Kendala

Takut ke rumah sakit dikarenakan presepsi tentang rumah sakit sarang dari penyakit ketika pandemi

Motivasi

ingin mendapatkan pelayanan yang lebih baik dari sebelumnya

Moch. Harsono
Umur : 45 Tahun
Pekerjaan : Wiraswasta
Alamat : Lakarsantri, Surabaya
Kepribadian : Sabar, Pelupa, Teliti

Tentang

moch harsono merupakan seorang wiraswasta yang tinggal di lakarsantri kota surabaya. dimasa pandemi seperti ini harsono sangat memperhatikan kesehatan dan keadaan tubuhnya saat ini karena dimasa seperti ini harsono sering parno ketika mengalami sedikit perubahan kesehatan pada dirinya

Figure 1. *Patient User Persona*

Requirement Definition
a) User journey

This section obtains it by conducting a *review* on the *website* according to the scenario created. The results obtained are unclear and incomplete information, confusing and unattractive appearance, *confusing website* flow and the need for additional features and improvements existing features.

b) Scenario

The scenarios created are online listing, making appointments and online consultations. Scenarios are created to map out what users are doing.
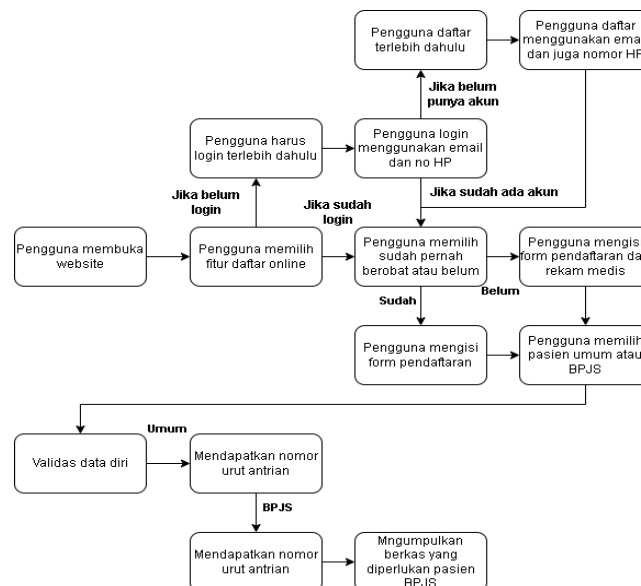
Figure 2. Online Listing Scenarios
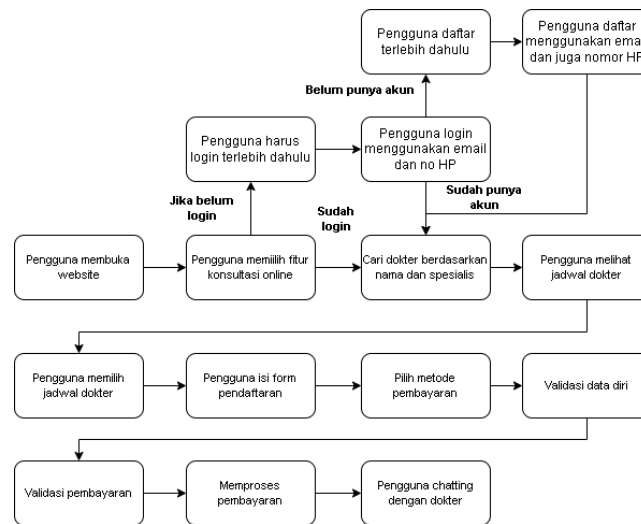
Figure 3.   Online Consultation Scenarios

c) System flow

This section is used to compile the system flow on the *website*. The system's flow created is online listing, making appointments and online consultations.

Framework Definition

The wireframe section that was made using the nunito font and the use of colors did not take colors from the old website because there needed to be improvements in the initial evaluation.
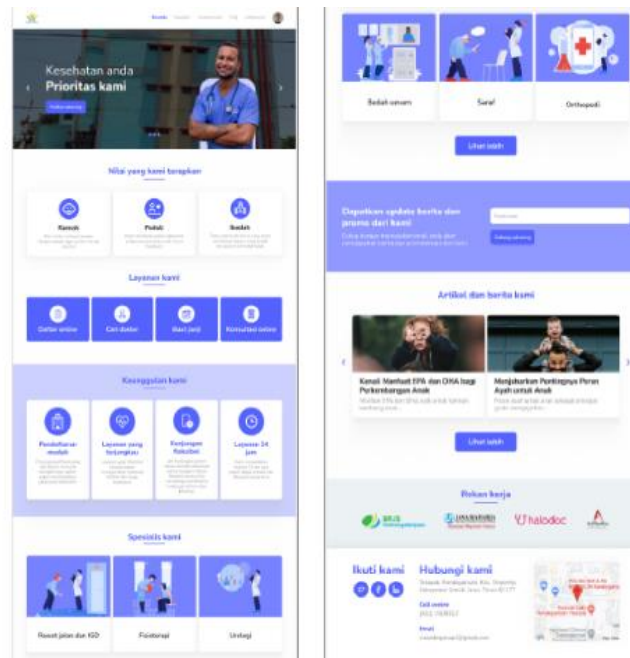
The arrangement of *wireframes* is made based on the problems on the *website*. These problems can be seen in   the interview,   initial evaluation and *user journey* sections.
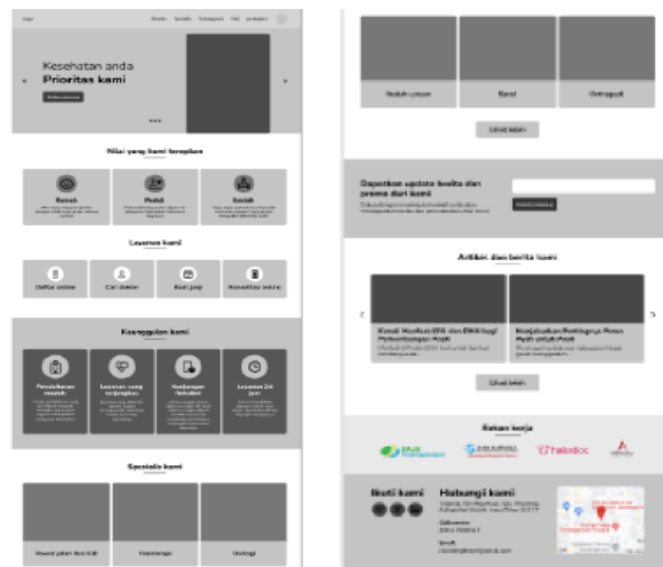
Figure 4. *Wireframe*

Refinement

In the section,   prototyping is carried out by the *wireframe* made at the *framework definition* stage.

Figure 5. Prototype

Support

At this stage, a final evaluation is carried out on the prototype design that has been made. Before conducting the final evaluation, *a testing* scenario is made. *Testing* scenarios are created to plan prototype testing that has been designed to find out whether the problem can be solved or not. The *testing* scenario is divided into two: letting users review the system prototype, recording user journey mapping, and deploying questionnaire.

In the *user journey mapping,* positive results were obtained related to the appearance, clarity of information, existing features and the flow of the prototype made. After that, the patient is given a questionnaire to find out the patient's response regarding the prototype made. Questionnaires are created based on *usability testing*.

Table 6. Final Evaluation Results of *Learnability* Indicators

Indicators	Response				Mean
	STS (1)	TS (2)	S (3)	SS (4)	
L1	0	0	18	44	3.71
L2	0	0	10	52	3.83
L3	0	0	24	38	3.61
L4	0	0	20	42	3.68
L5	0	0	20	42	3.68
Average					3.66

Table 6 represents the final evaluation of the *learnability* indicators after the system prototype has been made. The results obtained were an average value of 3.70 from a scale of 4 and an increase from the initial evaluation of 2.49 from a scale of 4. So based on the results of the final evaluation, it can be concluded that the patient feels that the prototype of the system is easy to learn.

Table 7. Final Evaluation Results of *Effeciency* Indicators

Indicators	Response				Mean
	STS (1)	TS (2)	S (3)	SS (4)	

E1	0	2	18	42	3.64
E2	0	0	17	45	3.72
E3	0	0	21	41	3.66
Average					3.67

Table 7 represents the final evaluation of the *efficiency* indicator after the system prototype has been made. The results obtained were an average value of 3.67 from a scale of 4 and an increase from the initial evaluation of 2.02 from a scale of 4. So based on the results of the final evaluation, it can be concluded that the patient feels that the prototype of the system created is efficient to use.

Table 8. Final Evaluation Results of *Memorability* Indicators

Indicators	Response				Mean
	STS (1)	TS (2)	S (3)	SS (4)	
M1	0	0	22	40	3.64
M2	0	1	21	40	3.63
M3	0	0	15	47	3.76
Average					3.68

Table 8 represents the final evaluation of the *memorability* indicator after the system prototype has been made. The results obtained were an average value of 3.68 from a scale of 4 and an increase from the initial evaluation of 2.58 from a scale of 4. So based on the results of the final evaluation, it can be concluded that the patient feels that the prototype of the system made easy to remember how it is used and the symbols used.

Table 9. Final Evaluation Results of *Indicators Errors*

Indicators	Response				Mean
	STS (1)	TS (2)	S (3)	SS (4)	
R1	0	0	21	41	3.66
Average					3.66

Table 9 is the result of the final evaluation of the *errors* indicator after the system prototype has been made. The results obtained were an average value of 3.66 from a scale of 4 and an increase from the initial evaluation of 1.87 from a scale of 4. So based on the results of the final evaluation, it can be concluded that the patient feels that the prototype of the system created has a notification when doing unwanted things.

Table 10. Final Evaluation Results of *Satisfaction Indicators*

Indicators	Response				Mean
	STS (1)	TS (2)	S (3)	SS (4)	
S1	0	0	17	45	3.72
S2	0	0	18	44	3.71
S3	0	0	18	44	3.71
Average					3.71

Table 10 is the result of the final evaluation of the *satisfaction* indicator after the system prototype has been made. The results obtained were an average value of 3.71 from a scale of 4 and an increase from the initial evaluation of 2.09 from a scale of 4. So based on the results of the final evaluation, it can be concluded that patients feel that the prototype of the system can provide satisfaction when used.

Table 11. Comparison of Initial Evaluation and Final Evaluation

No.	Indicators	Mean		Ket.
		Before	After	
1.	L1	2.97	3.71	Increase
2.	L2	3.01	3.83	Increase
3.	L3	1.89	3.61	Increase
4.	L4	2.51	3.68	Increase
5.	L5	2.08	3.68	Increase
6.	E1	1.95	3.64	Increase
7.	E2	2.03	3.72	Increase
8.	E3	2.08	3.66	Increase
9.	M1	2.68	3.64	Increase
10.	M2	2.49	3.63	Increase
11.	M3	2.64	3.76	Increase
12.	R1	1.87	3.66	Increase
13.	S1	2.16	3.72	Increase
14.	S2	1.95	3.71	Increase
15	S3	2.15	3.71	Increase
Sum		34.46	55.36	Increase
Average		2.30	3.69	

CONCLUSION

Based on the prototype of the website produced with the design stages of *the goal directed design* using usability tests or evaluations, it gets an average value more significant than *the website* before improvement in terms of *learnability* , *efficiency*, *memorability*, *errors* and also *satisfaction*. The increase in the value of the usability test results was based on the average value of all usability factors by 2.3 to 3.69 or there was an increase in the *usability* value by 60%. Referring to the results of the evaluation, the website prototype can be further implemented on the hospital *website* portal to improve hospital services through Website-based timeless interaction services are better and provide value in customer or patient service *value*.

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