

Implementation of human-centered design methods in designing application interfaces for nursing home service

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Abstract: In a nursing home, the elderly gets health services to support their daily life. These services are documented and reported periodically to elderly families. In addition to managing information about nursing services, there is other information that must also be managed properly to help the smooth operation of the nursing home. To support the information management process, reliable software is needed to have the functions and benefits that are in accordance with the needs. One of the supporting components that contribute to building good software is interface design. This study will discuss the design of nursing home service application interfaces that have fields, characteristics, and functions that are different from other fields, especially the field of special health services for the elderly. The purpose of this study is to provide an overview and insight to desktop, mobile, and web application developers regarding aspects of designing an interface that is acceptable to system users in nursing homes. This will certainly make it easier for developers to produce good and acceptable software. The design of the interface is carried out using the Human-Centered Design (HCD) method which applies a user-focused design approach so that it makes it easy to understand what their needs are. There are several stages in HCD, namely the stage of identifying and determining the context of the user (Understand and specifying the context of use), the stage of identifying user requirements (Specifying the user requirements), the stage of producing design solutions (Producing design solutions) and the stage of evaluating the design (Evaluating the design). This research produces an interactive and easy-to-use interface design because the testing process uses a prototype as a demonstration tool. The test results using the End User Computing Satisfaction (EUCS) method show that 88.25% of users are satisfied with the design made and in line with the needs of users in a nursing home.

Keywords: nursing home, HCD, interface, EUCS

History Article: Submitted 9 August 2021 | Revised 3 September 2021 | Accepted 12 October 2021

How to Cite: S. S. Wibagso and I. Celesta, "Implementation of human-centered design methods in designing application interfaces for nursing home service," *Matrix: Jurnal Manajemen Teknologi dan Informatika*, vol. 11, no.3, pp.150-161, 2021.

Introduction

As a place that provides health care services to the elderly [1], a nursing home does not only focus on health services. But further, it seeks to improve the information services that can be provided to the patient's family related to the care for each elderly. There is a variety of information in the orphanage including elderly data, elderly care, elderly mutations, visits, contributions, donations from donors in the form of goods and money, staff data, to donor data [2]. Data documentation activities have an important role in managing an organization, including a nursing home. Integration of data or information serves to assist services and provide comprehensive health information to patients, nurses, and families [3]. The better the management, the easier it will be for managers to provide information on elderly care to families.

To assist the operations of the orphanage in managing information, technology can be used as a reliable tool. The use of technology in the form of software or software can provide its advantages for users, one of which is to transform manual methods of documenting and managing data. With the use of software, information can be generated more effectively. The outcome of managing information is obtained in a faster and cheaper way.

In the last few years, the world of software is growing very rapidly starting from desktop applications, web to mobile. These developments have had a huge impact on changing the perspective of developers in designing and building software. The big thing that is a concern in the

development process is to build an interface or commonly referred to as a user interface (UI). UI is an important and key component of interactive software applications [4]. The interface is a design display that refers to software functions and interactions between users through commands, inputting data, and using content [5]. One of the productivity successes of a software application can be seen from the good or bad interface created. This is a very important factor because most of the operations on software applications are carried out by the user using the interface. Inter-face design support for applications makes the final software product more leverage in improving usability so that it can provide several benefits including increased productivity, increased user well-being, stress avoidance, increased accessibility, and reduced risk of harm [6].

Many bad designs are produced as a result of ignoring the people for whom the design is intended [7]. For this reason, therefore the interface design that is built can run and function properly, an appropriate design method is needed. One method that can be used in designing the interface is the Human-Centered Design (HCD) method. HCD is an approach in the design process that involves users and stakeholders. This approach is very useful in producing a usable and interactive system between humans and the system because of its focus on the user [8]. By maintaining a focus on the needs and requirements of users it will result in increased satisfaction and acceptance of the system [9]. The ISO 9241-210 standard describes the potential benefits of following a design approach that improves usability and the human factor [6].

Putting the user at the heart of the design process means making him or her the guiding principle of the philosophy associated with HCD, namely universal design. The goal of universal design is to create products, environments, and services for all users regardless of their physical or cognitive abilities [10]. Through HCD, the interface design that is designed can be in line with the expected usability of the software that will be built. User-centered interface design is developed to address poor software product design and aims to emphasize user needs and capabilities to improve understanding and use of the software.

Based on the above background, the authors are interested in conducting research on designing web-based nursing home software application interfaces with an HCD approach that adapts to user needs. Web-based software is the choice because it is dynamic and has the convenience of managing changes in data display [11]. The result to be achieved in this research is an interface design in the form of a prototype which can later be used as a design display recommendation in developing nursing home service applications.

Methodology

The definition of Human-Centered Design (HCD) according to the ISO 9241-210 standard is a human-centered design through a systems design and development approach that aims to make the system interactive, more useful, usable, and productive [12] by focusing on the use of the system and human application, ergonomic factors, and knowledge and skills usability technique [6]. The HCD method helps in the research process to understand the needs of users and stakeholders in meeting the requirements of the design [13].

HCD is a system design-oriented process that can be applied early in the design process, even before a system exists that can allow user feedback [12]. HCD is a mandatory upstream process that allows the design team to incorporate human requirements into the system design which is usually scenario and prototype-based. Information amassing for HCD is regularly blended methods, depending closely on qualitative investigations to recognize contextual and user needs, in addition to quantitative information to evaluate opportunity designs or answers thru a couple of iterations [14]. The HCD process consists of gathering human factors issues from the appropriate user community, or general-ly actors anticipated to act on the designed system. Actors can be end-users who also act as managers who have to fix the system in case of failure. This allows users to play a role in producing designs for usability but also for designs that are easy to maintain [15].

In the research to design the nursing home service application interface, several stages were carried out [16] by adopting the Human-Centered Design (HCD) method. These stages can be seen in Figure 1.

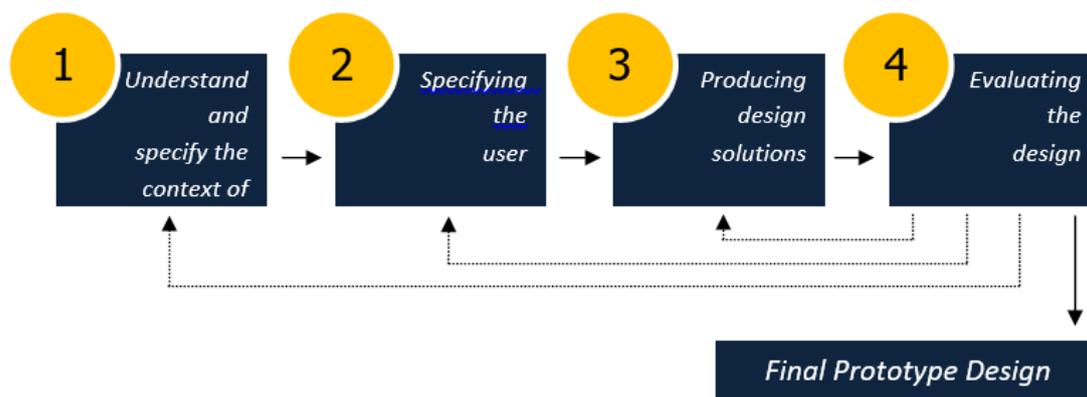


Figure 1. Interface design using HCD method

1. Understand and specify the context of use: At this stage, identification and determination of the context of use from the user's side of the nursing home are carried out to produce identification in the form of group division, characteristics and user roles in the application environment to be built.

2. Specifying the user: At this stage, the detailed requirements of the nursing home are carried out by looking specifically at the expected functional and non-functional needs. This phase will produce detailed requirements, a list defining user tasks, and use case diagrams that are used to describe the workflow and scenarios of the application.

3. Producing design solutions: At this stage, a design solution is carried out by designing an application interface by drawing a sitemap and using a prototype with a high degree of accuracy (high-fidelity prototyping).

4. Evaluating the design: At this stage, evaluation of the design and validation of user needs is carried out through usability testing to measure aspects of effectiveness, efficiency, and user satisfaction. This phase is carried out interactively if the results are not in accordance with the needs. After the evaluation stage, the accepted design will be used as the final prototype design of the application interface.

Results and Discussions

Based on the design flow that adopts the Human-Centered Design method, this chapter will explain the results of each stage starting from determining the context of application usage, describing detailed specifications of user needs, and implementing interface design solutions. Furthermore, an evaluation of the design that has been made through interface testing in the form of a prototype will be carried out and evaluate the test through a questionnaire that refers to the EUCS (End User Computing Satisfaction) method.

Results

From the identification and determination of the context of use through interviews at a nursing home, the results of the group division, characteristics, and roles of users are shown in Table 1.

After taking a deeper look at the specifications of the expected functional requirements, the detailed specifications of user requirements are obtained. Table 2 shows examples of elderly nursing services performed by nurses and Table 3 shows examples of financial and donation management by finance staff.

Table 1. Group division, user characteristics, and roles

Group	Characteristic	Roles
Nurse	Provide health care services to the elderly.	As a nurse who uses a system to record nursing action data for the elderly and reports periodically to the elderly family.
Administrative staff	Carry out administrative activities that occur in a nursing home.	As an administrative staff who uses the system to record and manage data related to the elderly, elderly mutations, staff, donors, elderly family visits, and elderly food intake menus.
Financial staff	Carry out recording and documentation activities related to finances in a nursing home.	As a financial staff who uses the system to record and manage data related to the receipt of payment for the elderly, donations of money, and goods from donors.
System Admin	Manage the system and management system users in a nursing home.	As an admin who uses the system to add and subtract users according to the roles and needs of the nursing home. In addition, the system admin has a role to fully control the running of the system.

Table 2. The detailed specification of user requirements for elderly nursing services

No.	Function Detail Name	Description
1.	System login	Enter username and password.
2.	Dashboard and Main Menu	Information summary of elderly data, nursing services, and navigation menus.
3.	Elderly data	Search for elderly data information.
4.	Elderly nursing action data	Management of nursing action data for the elderly.
5.	Logout	Log out of the system.

Table 3. The detailed specification of user requirements for donations and financial management

No.	Function Detail Name	Description
1.	System login	Enter username and password.
2.	Dashboard and Main Menu	Information summary of elderly data, donors, donations of money, donations of goods, and navigation menu.
3.	Money donation data	Data management of monetary donations from donors.
4.	Item donation data	Management of data on donations of goods from donors.
5.	Elderly contribution data	Management of data on payment of elderly contributions.
6.	Logout	Log out of the system.

The detailed list of task definitions for each user can be seen in example table 4 which shows a list of user task definitions for elderly nursing services and table 5 which shows a list of user tasks for donations and financial management.

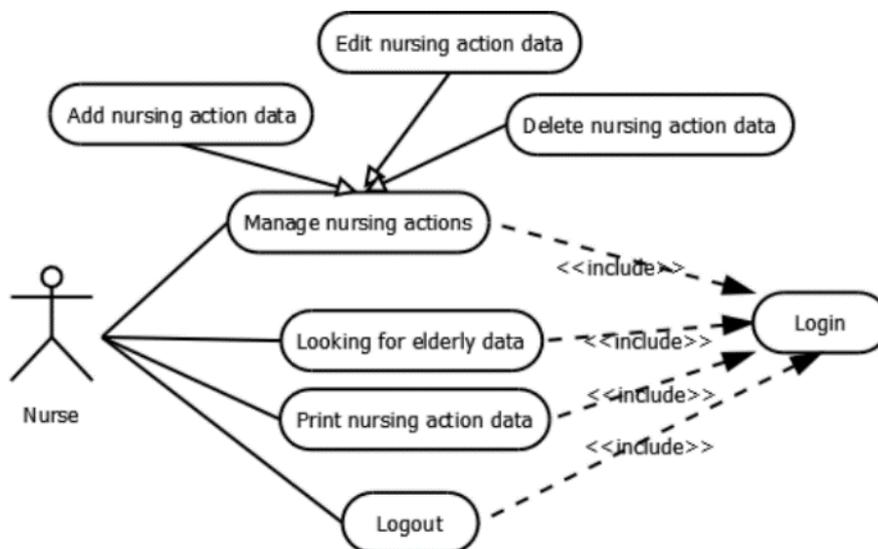
Table 4. User duties defined list for elderly nursing services

No.	Task	Objective
1.	Open dashboard and main menu	Looking at the summary, looking for elderly data, and looking for nursing action data for the elderly.
2.	Adding data on nursing actions for the elderly.	Manage data on nursing actions for the elderly.
3.	Print reports on nursing actions for the elderly periodically.	Produce nursing action documents for the elderly that will be sent to the family.

Table 5. User task defined list for donations and financial management

No.	Task	Objective
1.	Open dashboard and main menu.	View summaries, look for elderly data, look for data on donations of money and goods.
2.	Add money donation data.	Manage data on donations of money from donors.
3.	Add item donation data.	Manage data on donations of goods from donors.
4.	Adding data on elderly contributions.	Manage data on payment of elderly contributions.

To explain in more detail, the interactions between users (actors) and systems, use case diagrams are needed that can be used to visually explain the context of interaction between users and the system [17], workflows, and scenarios of each user. The use of the use case diagram itself aims to analyze the design of a system [18]. Figure 3 shows an example of a use case diagram for nursing services for the elderly and Figure 4 for the management of donations and finances.

**Figure 3.** Use case diagram of elderly nursing services

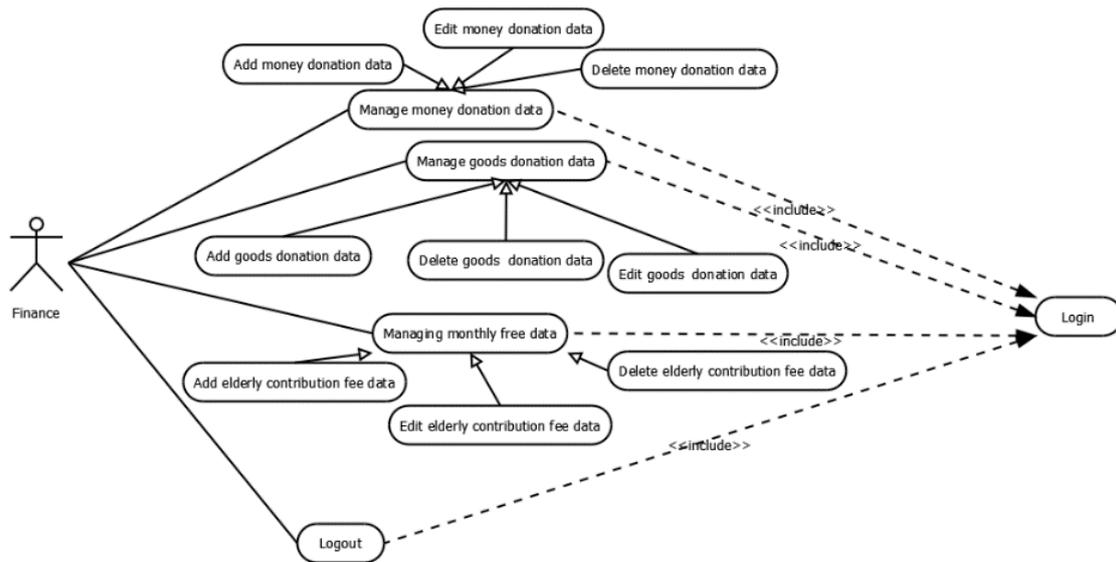


Figure 4. Use case diagram of donations and financial management

The next stage is the stage of making a solution whose design is carried out through 2 stages, namely sitemap design and application interface using prototypes. The sitemap is useful as mapping information for all content contained in the application [19] and also can be used to ease or arrange code dan its file [20]. The results of the sitemap are shown in Figure 5, the sitemap for a nursing home service application below.

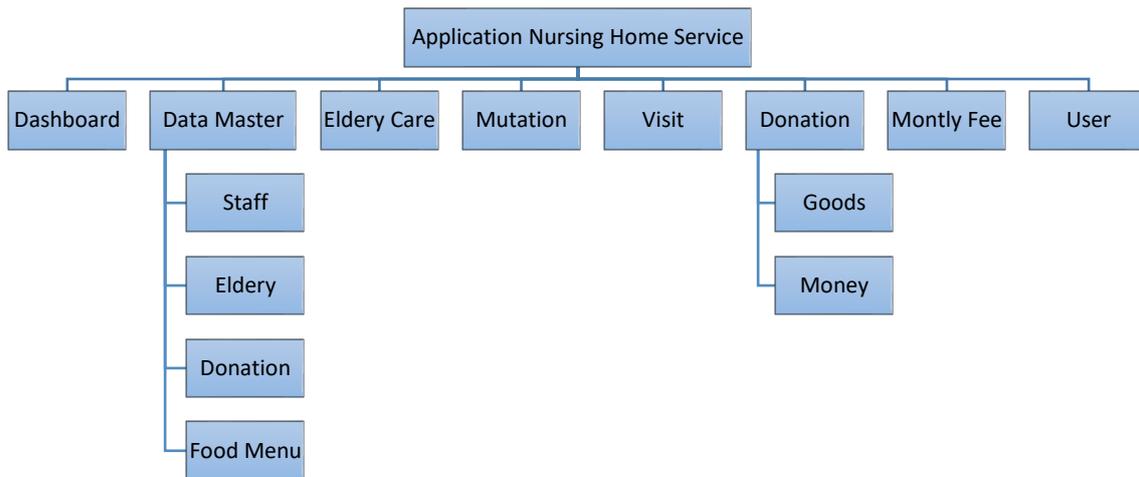


Figure 5. Nursing home service application sitemap

Based on the workflow of each user in the use case diagram, a prototype for a nursing home service application can be designed based on 4 access rights, namely:

1. Interface for nursing services accessed by nurses.

Interface design for nurses is only limited to access to nursing care for the elderly. Figure 6 shows an example of an interface design to add data for elderly nursing actions and Figure 7 shows an interface to view and search for elderly nursing data.

Add Nursing Action ✕

Code

Date

Eldery Name

Staff

Complaints

Treatment

Description

Figure 6. Display addition of elderly nursing data

Manage / Elderly Care

+ Action
Print

Show 10 entries

Code	Date	Eldery Name	Staff	Complaint	Treatment	Description	Action
TP021220	2020-12-08	Dina Mariani	Rinto	No complaints	Routine check	In a good condition	View Delete
TP020421	2021-04-24	Budiarto Karya	Nuri Sari	Stomach ache	Give laxatives	Incredible twisting pain	View Delete
TP011220	2021-03-03	Budiarto Karya	Nuri Sari	Pain in the waist	Given pain medication	Fall out of bed	View Delete
TP010421	2021-04-23	Budiarto Karya	Deden	Headache	Give pain medication	Re-examined 4 hours later to monitor his health	View Delete
Code	Date	Eldery Name	Staff	Complaint	Treatment	Description	Action

Showing 1 to 4 of 4 entries

Previous
1
Next

Figure 7. Display of elderly nursing data search

2. Interface for administrative services accessed by administrative staff.

The interface design for administrative staff is only limited to access to staff data, the elderly, donors, food menus, transfers, and visits. Figure 8 shows an example of an interface design for viewing and searching for elderly data and Figure 9 shows an interface for searching for nursing history data for each elderly.

Master Data / Eldery

[+ Eldery](#) [Print](#)

Show 10 entries Search:

Code	Reg. Date	Name	Family Contact	Gender	Phone	Status	Photo	Action
P000010126	2020-10-11	Budiarto Karya	Male	Dewi	0676654353	Active		History View Hapus
P000010121	2020-10-07	Dina Mariani	Male	Roni W	08565354354	Active		History View Hapus
P000010120	2020-10-21	Lina Wati	Female	Hendri	08786675456	Active		History View Hapus

Figure 8. Elderly data search display

Manage / Nursing Action History

Start Date

End Date

[Find](#) [Reset](#) [Print](#)

Show 10 entries Search:

Code	Date	Eldery Name	Staff	Complaint	Treatment	Description
TP020421	2021-04-24	Budiarto Karya	Nuri Sari	Stomach ache	Give laxatives	Incredible twisting pain
TP011220	2021-03-03	Budiarto Karya	Nuri Sari	Pain in the waist	Given pain medication	Fall out of bed
TP010421	2021-04-23	Budiarto Karya	Deden	Headache	Give pain medication	Re-examined 4 hours later to monitor his health
Code	Date	Eldery Name	Staff	Complaint	Treatment	Description

Showing 1 to 3 of 3 entries Previous [1](#) Next

Figure 9. Display of elderly nursing history data search

- Interface for financial management and donation services accessed by finance staff. Figure 10 shows an example of an interface design for adding item donation details.

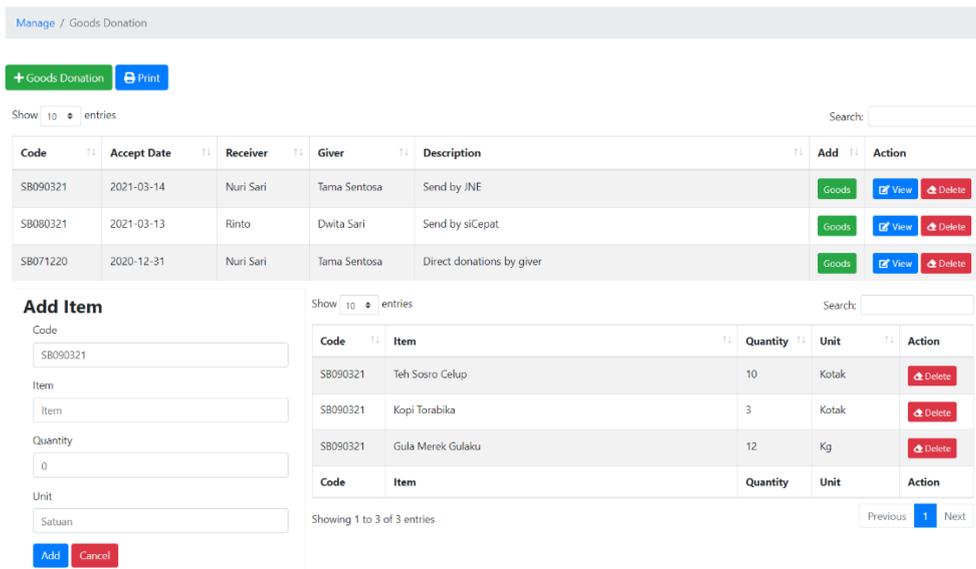


Figure 10. Display addition of goods donation details

4. Interface for all services accessed by system admin.

The admin system interface design includes all the access that nurses, administrative staff, financial staff have plus the system user management interface. Figure 11 shows the design of the navigation menu interface and the system admin dashboard.

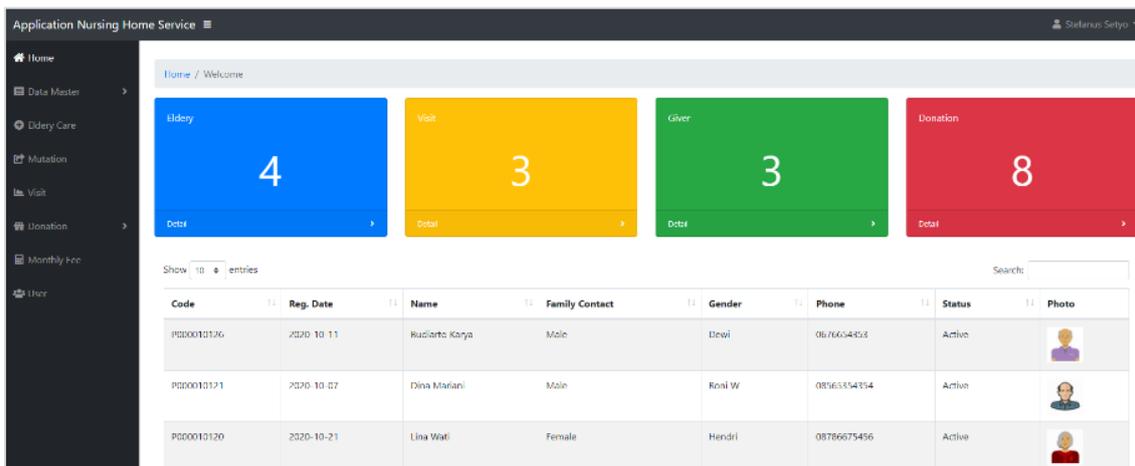


Figure 11. Display navigation menu and system admin dashboard

Discussions

There are two steps taken in conducting usability testing to measure the effectiveness, efficiency, and user satisfaction aspects of the interface design, namely by testing the application based on its access and followed by filling out a questionnaire. A list of questionnaire question items based on the EUCS (End User Computing Satisfaction) method where the question instruments include content, accuracy, format, ease of use, and timeliness in obtaining information [21]. EUCS is an important determinant that affects the user's intention to use the system [22], which in this case is represented in the user interface. Table 6 below shows a list of questions that will be asked to the user after completing the trial use of the application.

Table 6. List of questionnaire

EUCS Dimensions	Question Code	Question
<i>Content</i>	C1	The featured content of the nursing home service application prototype is in accordance with the needs.
	C2	The featured content of the nursing home service application prototype is clear and easy to understand.
	C3	The featured content of the nursing home service application prototype can help the performance of the staff concerned.
	C4	The data displayed on the prototype of the nursing home service application is accurate or in accordance with the data entered.
<i>Accuracy</i>	A1	The data displayed on the prototype of the nursing home service application is accurate or in accordance with the data entered.
	A2	Each link in the application prototype menu that is clicked always matches the page in question.
<i>Format</i>	F1	The interface design created has a menu structure and links that are easy to understand.
	F2	The interface design made makes it easy for users to use the application prototype.
	F3	The display interface design for text types, icons, and colors has an attractive arrangement.
<i>Ease of Use</i>	E1	The prototype of the nursing home service application can be accessed easily using a mobile phone, tablet, laptop, or computer.
	E2	The nursing home service application prototype is very easy to use.
<i>Timeliness</i>	T1	Information about nursing home services can be obtained quickly through this application prototype.
	T2	Data search results can be done quickly and precisely.

Table 7. Test results using EUCS method

Respondent	Question Score												Total	Score	
	C1	C2	C3	C4	A1	A2	F1	F2	F3	E1	E2	T1			T2
1	3	3	4	3	4	4	4	3	4	4	4	4	4	48	92.31
2	3	3	3	3	4	3	3	4	4	4	4	4	4	46	88.46
3	4	4	4	3	3	4	4	4	4	3	4	3	4	48	92.31
4	3	3	3	4	4	4	3	3	3	3	3	3	4	43	82.69
5	3	3	3	3	3	3	3	3	3	3	3	3	3	39	75.00
6	4	4	4	4	4	4	3	3	4	3	3	3	4	47	90.38
7	4	3	3	4	4	4	3	4	3	4	3	3	3	45	86.54
8	3	3	3	4	3	4	4	4	3	3	4	4	4	46	88.46
9	4	4	4	4	4	4	4	4	4	3	4	4	4	51	98.08
Score Total														794.23	
Average														88.25	

The total average result of testing using the EUCS method is 88.25%. The percentage figure is greater than 70% which means that the interface design of the application that is built is considered valid [23] and meets user needs with an easy-to-reach, accurate and fast display in managing information related to services in a nursing home.

Conclusion

This study resulted in an application interface design for a nursing home service based on the needs of nurses, administrative staff, finance staff, and leaders with a satisfaction level of 88.25%. The Human-Centered Design (HCD) method provides very clear guidance in the interface design stages therefore it can produce interactive and easy-to-use designs for users. The next researchers need to carry out further research on the characteristics of the information needed in another nursing home. The more and richer the information obtained, the more complete the reference for the development of the information system for the nursing home. This interface design needs to be developed into a nursing home information system application that can be used to simplify and speed up the information processing process at the home and improve the quality of information to elderly families and related agencies.

Acknowledgments

I would like to express my special thanks to the Chancellor, LPPM, and my colleagues at the Musi Charitas Catholic University for their support on this research can be completed properly. I hope this article can contribute to improving the information management of nursing home services and add insight to the readers.

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