Health Examinaton Facility Design Mobile

For Elderly

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Abstract— The high life expectancy is one indicator of the success of development in the health sector. The high life expectancy causes the higher the number of elderly population, which if not handled properly will become a new problem. The elderly population is an age group that is prone to degenerative diseases so physical condition measurements need to be done routinely to be able to monitor health conditions. This is so that the condition of the body can always be controlled so that it can be treated early by the doctor when he has a symptom of a health disorder. The cost of a doctor's visit is expensive and the distance to a health care center that is far away is a big obstacle. The mobile health screening facility is one solution that can be used to monitor several elderly health parameters. The availability of independent and mobile checking facilities that are effective, comfortable, safe, healthy and efficient (ENASE) is very much needed to facilitate the elderly in conducting health checks. Therefore in this research a mobile health facility will be designed that takes into account all the needs of the elderly.

Keywords—Mobile Facility, Health Examination, Elderly, Ergonomic, House of Ergonomic

I. INTRODUCTION

The high life expectancy shows the better quality of public health and is one indicator of the success of development in the health sector. In line with that, the high life expectancy also causes a higher number of elderly population, which on the other hand becomes a development challenge, which if not handled properly will become a new problem. BPS predicts that the percentage of Indonesia's elderly population will reach 28.8 million (11.34%). The size of the elderly population certainly has an impact on various aspects of life, both social, economic and especially health, because with increasing age, the function of the body's organs will decrease both due to natural factors and due to disease. Measurement of the physical condition of the elderly on a regular basis needs to be done to be able to monitor health conditions. This is so that the condition of the body

can always be controlled so that it can be treated early by the doctor when he has a symptom of a health disorder. There are six vital signs as initial parameters in the examination of the patient's health conditions in medicine such as checking blood pressure, body temperature, heart rate, oxygen saturation, weight, and height. Routine measurements are needed as an initial diagnosis to determine the health condition of the body so that it can be treated early by the doctor when he has a symptom or health disorder [1].

At present, medical equipment and attention to improving health available today for the elderly with lower middle economic level apparently still not getting optimal attention. Checking the health condition on a regular basis can be done by conducting a health check directly to the doctor or doing the examination yourself. The cost of a doctor's visit is expensive and the distance to a health care center that is far away is a big obstacle. Examination by visiting a doctor requires more time and greater effort, especially for some people who have limitations such as elderly people. Besides visiting doctors regularly, health control can also be done independently. [2] has developed a medical device to monitor patients with sound output. Medical devices that have been developed to measure patient health parameters such as height, weight, body temperature, oxygen saturation, heart rate and blood pressure. The system developed by [2] is a medical record and patient monitoring system that can be accessed at any time by medical personnel (doctors) for the purpose of diagnosis and or therapy as well as knowing the patient's medical history.

[3] developed a health corner design for the elderly to routinely check vital signs using medical devices that have been designed by [2]. Health screening facilities are designed to bridge the elderly with medical devices so as to increase the ease and understanding of using existing medical devices. Facilities made in the form of a health corner that cannot be moved so it is not flexible enough to carry out checks in several places. By looking at this condition, the development

of mobile health screening facilities is an alternative to solving health services for the elderly. This paper will discuss the design of mobile health facilities for the elderly by utilizing medical equipment that has been developed by [2] and [3].

II. METHODOLOGY

Quality Function Deployment (QFD) is a structured planning and development method that allows the development team to clearly define customer needs and expectations, and evaluate the ability of products or services systematically to meet those needs and expectations. QFD is used to improve understanding of customers and to develop products, services and processes in a more customer-oriented way [4].

Ergonomic Function Deployment is the development of Quality Function Deployment (QFD) by adding new relationships between costumer needs and ergonomic aspects of the product. This relationship will complete the house of quality matrix form which also translates into ergonomic aspects [5]. Product design consists of 4 stages :

1. *House of Quality*

2. *Part Deployment*.

3. *Process Deployment*

4. *Manufacturing/Production Planning*

Overall, the product design process using the EFD method is not much different from QFD. There are differences in the first stage (House of Quality). At this stage, the ergonomic aspect will be involved at process of identifying costumer needs. The ergonomics aspects discussed include Efficient, Comfortable, Safe, Healthy and Effective [6]. Effective is the achievement of targets or targets that have been determined. Comfortable is a condition where a person is in a condition without anxiety, to provide a stable level of performance and free from risk. Safe is a condition free from disaster, threats, and dangers. Health is eliminating things that can cause health problems or illness and Efficient is a goal that can be achieved with a low effort, cost, sacrifice.

This research focused on first stage (House of Quality). The stages of this research are :
1. Determine respondent characteristic
2. Design and Preliminary Questionnaires Distribution
3. Questionnaires Testing, consist of validity and reliability testing
4. Design and Research Questionnaires Distribution
5. Determine House of Quality, consist of :
   a. Determination of product attributes using ergonomic concepts. Product attributes are translations of customer needs to facilitate the design team to determine the characteristics of technical aspects.
   b. Planning matrix. This process is the stage of market research and strategic planning which consists of Importance to Customer (IC), Current Satisfaction Performance (CSP), Goal, Improvement Ratio (IR), Sales Point (SP), Raw Weight (RW) and Normalized Raw Weight (NRW).

c. Determination of product technical specifications..
d. Determination of the relationship matrix
e. Determination of technical response.
f. Determination of technical correlation.
g. Determination of technical matrix.
h. Design and development of product concepts using morphology charts
i.

III. RESULT AND DISCUSSION

There are 18 product attributes that will be questions in the questionnaire. The respondents are elderly, both male and female, in Panti Werda Karitas. The product attributes can be seen in Table I

TABLE I. Product Attributes

Atr.Num.	Atributes / Customer Needs
1.	There are instruction for every facilities
2.	There are instructions for using medical devices
3.	There are sensors that indicate the facilities is ready or has been used
4.	There are a warning sound if the user make a mistake when using the devices
5.	Free movement inside facility
6.	There are chair for user
7.	The cabin interior has a warm colour
8.	The floor material are strong, flat and not slippery
9.	The cabin has a good lighting
10.	There are facilities for access into and out of the facility with handrail
11.	There are supporting car body to keep the vehicle stable from any shake
12.	Has good air circulation
13.	The facility is always cleans.
14.	There are hand sanitizer for user
15.	Every facility are easy to understand and use
16.	Every medical devices and other facility are reachable
17.	Every instruction are readable and easy to understand
18.	Users don't need to change position much when using medical devices

All questions are valid and reliable. The next step is to calculate the planning matrix for all the attributes that can be seen in Table II. Based on normalized raw weight, there are 6 attributes with the highest priority, attributes number

1,5,8,15,16 and 17, while the attribute with the lowest priority is attribute 6.

TABLE II. Planning Matrix

Atr.Num	ITC	CSP	Goal	IR	SP	RW	NRW	Rank
1	3	1.000	4	4.000	1.5	18.000	0.086	1
2	3	3.233	4	1.237	1.5	5.567	0.026	14
3	3	1.000	3	3.000	1.5	13.500	0.064	7
4	3	1.000	3	3.000	1.5	13.500	0.064	7
5	4	1.000	3	3.000	1.5	18.000	0.086	1
6	3	3.367	4	1.188	1.2	4.277	0.020	15
7	3	1.000	3	3.000	1.2	10.800	0.051	11
8	3	1.000	4	4.000	1.5	18.000	0.086	1
9	3	3.500	4	1.143	1.2	4.114	0.020	16
10	3	1.000	3	3.000	1.5	13.500	0.064	7
11	3	1.000	3	3.000	1.5	13.500	0.064	7
12	2	3.267	4	1.224	1.2	2.939	0.014	18
13	2	3.167	4	1.263	1.2	3.032	0.014	17
14	3	1.000	3	3.000	1.2	10.800	0.051	11
15	3	1.000	4	4.000	1.5	18.000	0.086	1
16	3	1.000	4	4.000	1.5	18.000	0.086	1
17	3	1.000	4	4.000	1.5	18.000	0.086	1
18	4	3.533	4	1.132	1.5	6.792	0.032	13

The next step is to determine the technical specifications of the product for each product attribute. The specifications consist of a matrix and a value matrix (a unit of technical characteristics). There are 92 technical specifications that can be seen in Table III

After determine technical specifications, the next step is to determine the relationship matrix, technical response and technical matrix which will be summarized in the House of Ergonomic in Table IV. The results of the HoE show that based on normalized contribution, the technical specification with the highest priority is the placement of use medical devices instructions. There are three technical specifications with the lowest priority : the availability of hand sanitizer, dimensions of hand sanitizer and the amount of hand sanitizer

TABLE III. Product Technical Spesification

Num.	Product Technical Spesification	
	Metric	Metric Value
1	Type of air circulation	list
2	Back chair dimensions	cm
3	Base chair dimensions	cm
..	..	
..	..	
..	..	
90	Audio volume that indicates the examination is ready to begin	list
91	The background colour in the medical devices instructions	list
92	The text colour in the medical devices instructions	list

The design can be seen in Figure 1 and Figure 2. The results of this research are this health facility design mobile have applied ergonomic aspects. The effective aspect of this design is that users are able to doing health examination independently without the help of others. The comfortable aspect of this design is that it does not cause anxiety to the user so the design has a wide space and the availability of seats and the interior has a warm colour. The safe aspect of this design is to minimize the risk of accidents to users by using non-slippery floor material and there is hand rail for users. Healthy aspects of the this design are to minimize health problem by designing good air circulation and ensuring cleanliness in facility. The efficient aspect of this design is easiness of using facility which shows by the availability of instruction and the placement of medical devices so the user don't need change position much

IV. CONCLUSIONS

The design of health examination facility mobile for elderly have been designed to accommodate the characteristics and limitations elderly by considering aspects of ergonomic. Further research can be done making prototypes to test the design result

TABLE IV. House of Ergonomic

| Numb.	Customer Needs\Techincal Spesification	Availability instruction of sequences of use medical devices	……….	Placement of use medical device instructions	……….	Health examination facility dimensions	NRW
1	There are instruction for every facilities	2.817	……….	2.817	……….		0.000
		9	……….	9	……….		
2	There are instruction for order of use medical device		……….		……….		0.000
			……….		……….		
………	………	………	……….	………	……….	………	………
17	Every instruction are readable and easy to understand		……….	0.929	……….		0.000
			……….	9	……….		
18	Users don't need to change position much when using medical devices		……….		……….	0.909	0.000
			……….		……….	9	
Contribution		3.746	……….	5.603	……….	0.909	45.809
Normalized Contribution		0.0818	……….	0.1223	……….	0.0198	1
Prioritas		4	……….	1	……….	19	
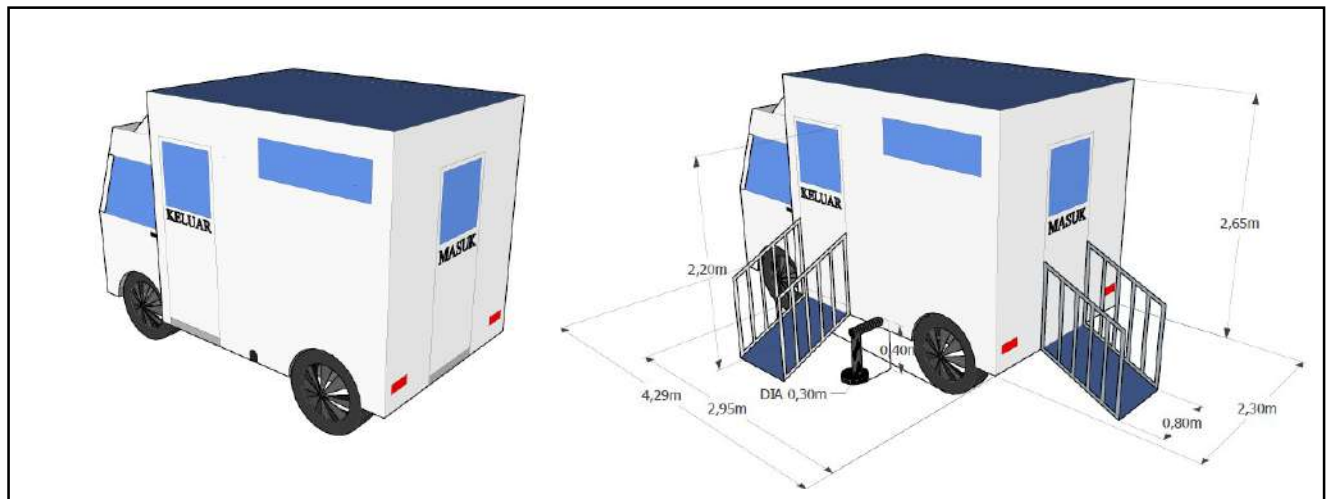
Fig 1. Outside View
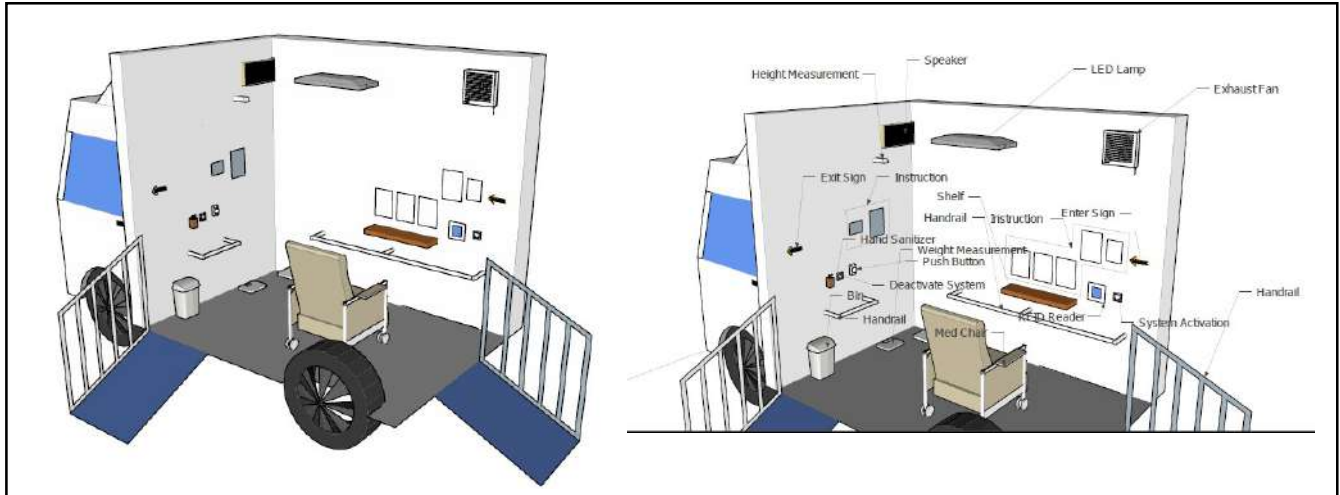
Fig 2. Inside View

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