The Evaluation of Child's Health Monitoring System Using the Usability Testing Approach

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Abstract— **The development of information and communication technology brings considerable changes in every aspect. This change certainly affects humans in obtaining information. At present information is something that is very important for every organization in running its business processes. Health is one of the capitals in the development of the State. POSYANDU is one of the organizations carried out by the community in order to increase the participation of the community in developing health activities including reducing infant mortality, knowing the nutritional status of toddlers, knowing the condition of child development. The resulting data from POSYANDU activities can be used as a source in health development planning in an area. This paper discusses the evaluation of child health monitoring systems by using usability testing. The result is that the built system has fulfilled the elements of usefulness, ease of use, ease of learning, and satisfaction. The average result of a reusability test with a value of 4.2 indicates that the system is very easy to use. Requirements required by users of the system have also been met, so the system works according to user expectations.**

Keywords — Information, Mortality, Health, Usability, Information Technology Medic.

I. Introduction

Information technology has become a necessity for organizations today. All aspects of human work in an organization today require the availability of technology to assist in solving problems or tasks faced by humans. Effectiveness and efficiency of time becomes a significant need in solving a problem faced by the organization. Information technology is to uses one of supporters in the business process in the field of education, government, business, military or health. Information technology brings an important role in the current era this is because with the use of appropriate information technology will make the organization can determine the right decision [1] [2].

Health field is one of the areas that currently start to take advantage of information technology in handling problems. Use of this information technology can help the role of medical personnel starting from the registration process, treatment, medicine and post-treatment to be more effective and efficient. Mother and child health surveillance information system is one application that takes advantage of the development of information technology. The benefits gained from using this system are maternal and child health data can be monitored effectively and efficiently[3][4].

In other studies the use of information technology in the field of health is to help reduce the errors caused by human factors and in this case the medical personnel. The resulting mistake will certainly affect the decision to be made to the patient. The slightest mistake can have a fatal impact on the patient, therefore the use of this information technology can help to reduce the error rate[5].

Child health monitoring system is one system used to monitor the development of children from the age of 0 years to age 5 years, this is because at this time is the golden age of child development. At that age is in the best development for the child's physical and brain. Child growth period is a very risky period for every child's life, therefore it should be noted all aspects that support and affect this growth. Growth and development, two distinct but interrelated events and affect each other.

To support the process of child development, the Government of Indonesia through the Center of Health Services PUSKESMAS conducting monitoring process of growth and development through the program of "Pos Pelayanan Terpadu" (POSYANDU). POSYANDU program is one of the community self-help programs at village level, where the managers are volunteers who will get training from health personnel of PUSKESMAS. In POSYANDU activities, the community can be the implementer or as a party who is gets health services or about family planning. The main objectives in POSYANDU are the decrease of Maternal Mortality Rate (MMR) and Infant Mortality Rate (IMR). The targets of POSYANDU services are all people, especially babies, toddlers, pregnant women, nursing mothers, postpartum women, and women of infertile age (WUS) and fertile couples (EFA). POSYANDU activities consist of Maternal and Child Health (KIA), Family Planning (KB), immunization, nutrition improvement, prevention and control of diarrhea [6].

Problems encountered in the process of monitoring the child's health or child development is done either at the level of POSYANDU or in PUSKESMAS is the data presented unstructured. Data is still manually managed by involving minimal computer usage. This problem causes storage, dissemination and information management to be more risky. In general, the data generated in POSYANDU activities currently still use paper. Risks arise when the paper-based recording system includes requiring large space in storing data, data is damaged by environmental factors and it takes a long time to retrieve data ever entered. Another risk that can arise is an error in entering the measurement results either in the form of weight measurement or height measurement.

The use of computers to carry out the process of recording health data is now starting to do a lot. Various computer-based information systems are developed to produce accurate information. This paper discusses the

testing of children's health monitoring system with usability testing approach. Tests conducted to the application user group that is, health cadres at POSYANDU level and medical personnel at PUSKESMAS. The purpose of this test is to test the quality level of the software system whether it is easy to use, learn and encourage users to use the system as a positive tool in completing the task.

II. LITERATURE REVIEW

A computer-based information system requires the supporting components display in Fig. 1.
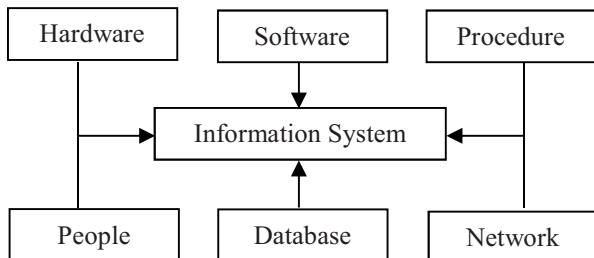

Fig. 1 Information System Components

Hardware is a physical component used in a computer-based information system. The hardware component consists of input components, processing components and output components. Software is a component that consists of a set of commands that allow hardware to be able to work in doing data processing. Procedure is a set of rules that are used to realize the processing of data and the desired output results. People are the parties responsible for the development of information systems, processing, and use of information systems output. A database is a collection of data stored systematically in a computer that can be processed or manipulated to become information. Network is a connecting system that allows resources shared or accessed by a number of users at a time.

To build an information system framework usage is very necessary, it is intended that in the future development of the system does not have difficulty. In addition, the use of framework can also speed up the work because the components are structured. One of the frameworks used in this research is to use the Code Igniter framework. This framework uses the MVC concept (model, View, Controller), using this concept will make it easier in system development, in addition the use of MVC can also reduce the time in the development of a system[7][8][9]. The model is part of the component that handles the validation, session state and control tasks, the data source structure (database). View is part of the component that serves to translate the code into the form of graphic or visual, so that the user can capture the information submitted. The controller is part of the component that handles the process of relationship between the model part and the view section. Controller functions to receive requests and data from the user then determine what will be processed by the application. Fig. 2 is display the schematic of the MVC concept.
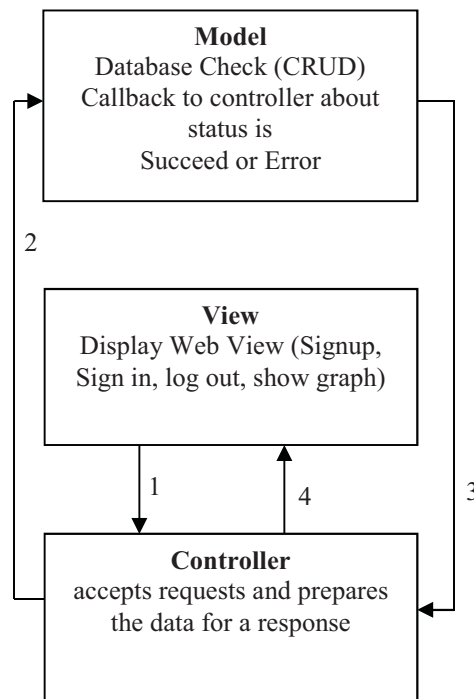

Fig. 2 MVC Schema

The database is one component in the development of information systems. Database is a very important aspect in the information system because it serves as a place for data storage to be processed further, therefore required a proper design process for data generated does not occur duplicate data, avoid the relationship between data is not clear. The database design process consists of 6 stages: data collection and analysis, conceptual database design, DBMS selection, database design logically, physical database design, and database system implementation.

III. RESEARCH METHOD

To achieve the goal, the right method is needed so that what has been described in the beginning can be achieved. The Prototyping method is used for the process of designing the monitoring system and for testing using reusability testing. Prototyping is one of the most widely used software development methods. The steps taken in this prototyping method is the process of collecting needs, together define the software format, identify the needs and the system created. Build prototype build prototyping by making temporary design. Evaluation Prototyping, this stage is done by the user whether it is appropriate or not and done until the user declared appropriate. Coding the system, at this stage the agreed prototyping is translated into the appropriate programming language. Testing the system, it aims to reduce software errors when used. Evaluation system, at this stage the user to evaluate the system that has been made is as desired. If not appropriate, then the process will be repeated again in the coding and testing stages. Using the system, Software that has been tested and accepted is ready to use. Fig. 3 is display a diagram of the prototyping method.
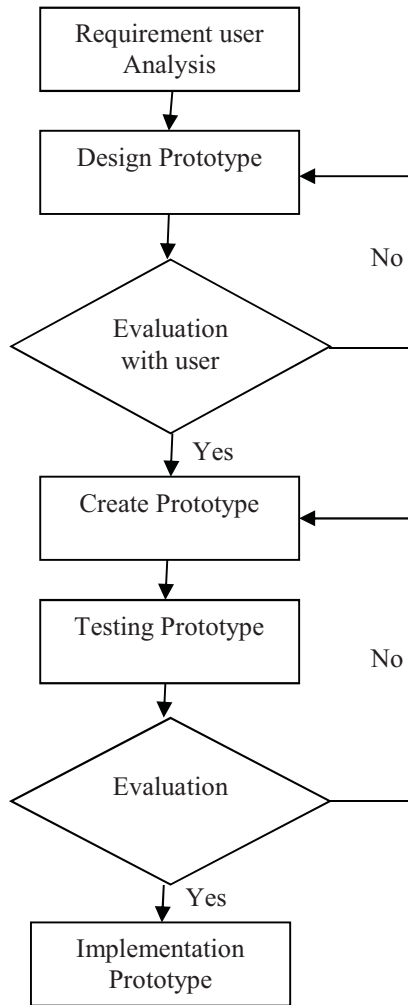
Fig. 4 Use Case Diagaram Monitoring System

Activity diagram of the system can be seen in Fig. 5.

Fig. 5 Activity Diagram

The design of the database table to be used is shown in Table 1 through Table 4.

TABLE 1. Table tb_baby

No	Field	Type	Length	Index
1	id	Integer	11	Primary key
2	name	Varchar	30	
3	dateofbirth	Date		
4	sex	Varchar	10	
5	Mothername	Varchar	30	
6	idMom	Integer	11	Foreign key
7	status	integer	1	

TABLE 2. Table tb_mom

No	Field	Type	Length	Index
1	idMom	Integer	11	Primary key
2	name	Varchar	30	
3	dateofbirth	Date		
4	sex	Varchar	10	
5	address	Varchar	300	

Fig. 3 Prototyping Method for Developing Software

The need for a child health monitoring system is as follows;

- System can read data from Member Card which has been equipped with RFID

- System can enter data of child health data in the form of immunization data, weight data, height data, medical history

- The system can visualize health data in graphical form

Prototype design process is done two stages of logic stage by using use case diagram and visual stage by using user interface design. In the use case diagram, there are three actors who will be involved in the health monitoring system of children, POSYANDU cadres, PUSKESMAS officers and system administrators. The use case diagram of the child health monitoring system is shown in Fig. 4.
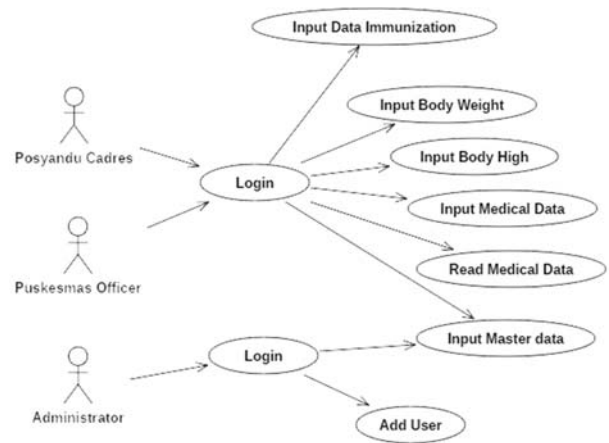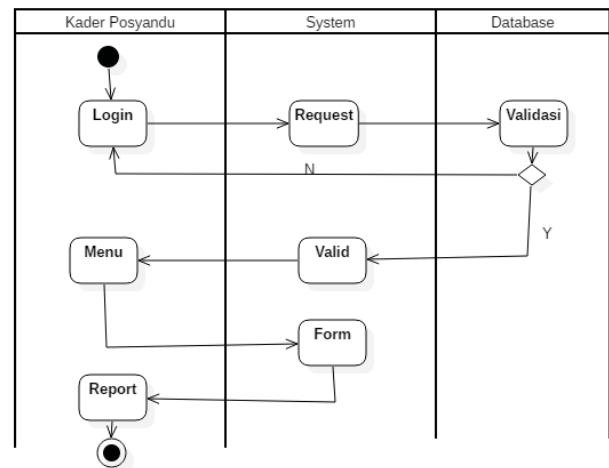
6	nik	Varchar	20	
6	namehusband	Varchar	30	
7	status	integer	1	

TABLE 3. Table tb_medicalbaby

No	Field	Type	Length	Index
1	id	Integer	11	Primary key
2	id_baby	Integer	11	Foreign key
3	date	date		
4	imun	varchar	200	
5	dateimun	date		
6	idMom	Integer	11	Foreign key
7	status	integer	1	

TABLE 4. Table tb_posyandu

No	Field	Type	Length	Index
1	id	Integer	11	Primary key
2	id_baby	Integer	11	Foreign key
3	date	date		
4	bb	decimal	(6,2)	
5	tb	decimal	(6,2)	
6	idMom	Integer	11	Foreign key
7	status	integer	1	

Testing the system using a usability test that aims to achieve the level of ease of the user side of the application at the time of interacting with the system. Tests conducted by distributing questionnaires to system users ie posyandu cadres, puskesmas officers and doctors public health centers. The measuring instrument used in the reusability testing is by using a Likert scale. The criteria used are 5 criteria, so the interval of each criterion is shown in equation 1.

$$Interval = \frac{High\ Range - low\ Range}{number\ of\ Criteria} \qquad (1)$$

Table 5 shows the interval class and criteria used in the determination of the results. The interval used by equation (1) is as follows

$$Interval = \frac{5-1}{5}$$
$$= 0.80$$

TABLE 5. Criteria and Interval

Interval	Criteria
1.00 – 1.79	Very difficult
1.80 – 2.59	Difficult
2.60 – 3.39	Quite easy
3.40 – 4.19	Easy
4.20 – 5.00	Very Easy

IV. RESULT

Implementation is done on a local server using XAMPP software. This monitoring system has four functions, namely

- Manage child and parent data
- Store child health data
- Displays weighting and height measurement information
- Displays a health information graph

Initial implementation is the database used in child health monitoring systems. Fig. 6 to Fig. 9 shows the results of database implementation.

Fig. 6 Implementation database tb_baby

Fig. 7 Implementation database tb_mom

Fig. 8 Implementation database tb_medicalbaby

Fig. 9 Implementation database tb_posyandu

Usability testing is by distributing 30 questionnaires to respondent of child health monitoring systems. The questionnaire model uses USE (Usefulness, Satisfaction, and Ease of use) Questionnaire. The use of this Questionnaire aims to determine the extent to which the system has been made can be used by the user [10]. Table 6 display USE (Usefulness, Satisfaction, and Ease of use) Questionnaire used in the usability testing.

TABLE 6. USE Questionnaire

No	Variable	Mean
	USEFULNESS	
1	The system helps improve effectiveness in child health monitoring.	4.50
2	The system is useful for parents to monitor the development of children's health and development.	4.76
3	The system can convey child health information in a short time.	4.56
4	The system is in line with user expectations.	4.50
	EASE OF USE	

1	Easy to use system.	4.19
2	System is user friendly.	4.02
3	System needs requires the fewest steps possible to accomplish what I want to do with it.	4.20
4	Users can use it without written instructions.	3.56
5	User can use it successfully every time.	3.59
EASE OF LEARNING		
1	User learned to use it quickly	3.73
2	User easily remember how to use it	3.85
3	The text of information delivery is easy to understand.	4.20
SATISFACTION		
1	Users satisfied with it	4.22
2	This system is fun to use in child health monitoring process.	4.50
3	The system works according to user expectations.	4.47

The results obtained for the mean of each category are as follows:

- Usefulness,

$$\text{Mean} = \frac{4.50+4.76+4.56+4.50}{4}$$
$$\text{Mean} = \frac{18.32}{4}$$
$$\text{Mean} = 4.58$$

- Ease of Use

$$\text{Mean} = \frac{4.19+4.02+4.20+3.56+3.59}{5}$$
$$\text{Mean} = \frac{19.56}{5}$$
$$\text{Mean} = 3.91$$

- Ease of Learning

$$\text{Mean} = \frac{3.73+3.85+4.20}{3}$$
$$\text{Mean} = \frac{11.76}{3}$$
$$\text{Mean} = 3.92$$

- Satisfaction

$$\text{Mean} = \frac{4.22+4.50+4.47}{3}$$
$$\text{Mean} = \frac{13.19}{3}$$
$$\text{Mean} = 4.39$$

The result of the test using the reusability got the average value is 4.2, based on the criteria in Table 5, it is obtained that the monitoring system is very easy to be used by POSYANDU cadres or PUSKESMAS officers. The average calculation for usefulness is 4.58, which means that the system is very helpful in providing health information to users of the system. Point ease of user obtained an average value of 3.91, this means the system easy to use by the user. Display system with user interface that is easy to use make user feel comfortable in using system. Point ease of learning shows the average value obtained is 3.59, it shows that the system easy to learn by the user. System users argue that the system is very fast to learn and instruction is easy to remember so that officer performance becomes faster. Point satisfaction shows an average value of 4.47, this explain that users feel very satisfied because the system can work in accordance with user needs.

V. CONCLUSION

The conclusion obtained in this research is by testing the reusability of the results obtained that the system has been built meets the elements of usefulness, ease of use, ease of learning, and satisfaction. The average result of a reusability test with a value of 4.2 indicates that the system is very easy to use. Requirements required by users of the system have also been met, so the system works according to user expectations..

REFERENCES

[1] J. Grabara, M. Kolcun, and S. Kot, 'The role of information systems in transport logistics', *Int. J. Educ. Res.*, vol. 2, no. 2, pp. 1–8, 2014.

[2] F. T. Lohrke, C. Frownfelter-Lohrke, and D. J. Ketchen, 'The role of information technology systems in the performance of mergers and acquisitions', *Bus. Horiz.*, vol. 59, no. 1, pp. 7–12, 2016.

[3] Kurniawan Teguh Martono, 'The role of management information system in data surveillance of maternal and child health', in *2015 2nd International Conference on Information Technology, Computer, and Electrical Engineering (ICITACEE)*, 2015.

[4] E. Davidson, A. Baird, and K. Prince, 'Opening the envelope of health care information systems research', *Inf. Organ.*, no. July, pp. 1–12, 2018.

[5] Z. Ali, M. Talha, and M. Alsulaiman, 'A Practical Approach: Design and Implementation of a Healthcare Software for Screening of Dysphonic Patients', *IEEE Access*, vol. 5, pp. 5844–5857, 2017.

[6] Simon Bolivar Manalu, 'Peran Posyandu Dalam Pembangunan Manusia', *Kompasiana*, 2015. .

[7] D. P. Pop and A. Altar, 'Designing an MVC model for rapid web application development', in *Procedia Engineering*, 2014.

[8] R. Das and D. Prasad Saikia, 'Comparison of Procedural PHP with Codeigniter and Laravel Framework', *Int. J. Curr. Trends Eng. Res. Sci. J. Impact Factor*, vol. 2, no. 6, pp. 42–48, 2016.

[9] N. Prokofyeva and V. Boltunova, 'Analysis and Practical Application of PHP Frameworks in Development of Web Information Systems', *Procedia Comput. Sci.*, vol. 104, no. December 2016, pp. 51–56, 2016.

[10] R. D. Stoll, A. A. Pina, K. Gary, and A. Amresh, 'Usability of a Smartphone Application to Support the Prevention and Early Intervention of Anxiety in Youth', *Cogn. Behav. Pract.*, vol. 24, no. 4, pp. 393–404, 2017.