

Design of Hospital Medical Equipment Management Information System

Arie Sulistiya¹, Artha Prabawa²

¹Posgraduate Studies in Health Informatics,

^{1,2}Departement of Biostatistics and Population, Faculty of Public Health, Universitas Indonesia

Abstract: The information system in its development is very helpful for hospital management in managing medical equipment. This study aims to design a hospital medical equipment management information system that is carried out by optimizing the availability and condition of medical equipment in hospital service units which makes it easy to track medical equipment, and for classification of hospital, types referring to Permenkes Number 56 of 2014 which describes the classification of hospitals with a list of medical equipment needs based on room and type of service. Then available in this information system design a tutorial link explaining the use of medical equipment according to SOP so that officers can always study every menu on medical equipment so that it supports providing services to patients and equipment can function according to its function and ease for technicians to find explanations in carrying out maintenance and repair. The research uses the System development life cycle (SDLC) method with a prototype approach which includes needs analysis with Context Diagrams, Entity Relational Diagrams (ERD), Table Relationship Diagrams (TRD), Data Flow Diagrams (DFD) Level 1, Standard Operational Procedure (SOP) Flowchart and design with stages that result in the design of mobile information system models and web applications.

Keywords : medical equipment, information system design, hospital

I. INTRODUCTION

Hospital is a health service institution that organizes complete individual health services that provide inpatient, outpatient, and emergency services[1]. Hospitals are required to provide the best possible service while ensuring that medical equipment is fit for use with conditions that can be operated properly during health service activities. Medical equipment is one of the factors that play an important role in providing health services in hospitals. Diversity and innovation of medical equipment significantly contribute to improving service quality and efficiency. Medical devices have become an important component of health services because medical devices enable health service providers to diagnose, treat, monitor, and provide therapy to patients in an appropriate service environment[2]

The deployment of medical equipment in hospital healthcare facilities is accelerating, on the other hand, the ability to manage medical equipment is still weak. The ability to manage medical devices has lagged far behind the deployment of medical devices. this is very risky and can be in vain and affect the quality of service to decrease[3]. The management of medical equipment is very important to ensure that the equipment continues to function effectively in usable working conditions and can function properly.

What is no less important is that the operation of the tool must be by the applicable SOP (Standard operating procedure)[4]. Its function here is during the process of testing the function of the tool which explains the use of the tool according to the SOP and information for preventing failure, as a guide for tool users while still paying attention to the tool's operating manual. Records of each medical device must include fixed asset data. This data is usually logged on work orders or service orders and can provide documentation for equipment maintenance either.

Hospitals increasingly require management of medical equipment systems to know documented SOPs and inventory locations, especially for commonly used portable devices. If the location changes, the officer can change the location in the system. Ability to record equipment location accurately[5]. According to research conducted by Yoo et al, the asset tracking system is more helpful in managing, moving, and placing assets than manual management and can find available devices quickly[6].

This medical equipment management information system is designed to support hospitals in classifying hospital types based on Permenkes number 56 of 2014[7] which explains the classification of medical equipment based on hospital class based on service units and types of services in each unit and the ease of determining equipment needs in service units.

Maintaining is an effort for good program management. Currently, there is no system available that can facilitate the management of medical equipment in the treatment room so that it can be integrated with related units in the hospital. Seeing this, it is felt that it is necessary to design a medical equipment management information system that will later be adapted to the hospital system.

II. RESEARCH METHODE

The design method used is the SDLC (System development life cycle) methodology, which is a software development system that uses the stages: planning, analysis, design, implementation, and use of the Raymond McLeod version of the system. . One of the models used is the prototype. The prototype method is a method that allows users to have an initial picture of the software to be developed and users can do testing before the software is released. and this method is also the best used to solve the constraints between users and system analysis. Which usually happens due to the inability of the user to clearly define the requirement[8].

This paper uses the prototype method which begins with a needs analysis that is described more clearly by analyzing the interaction of objects and functions in the system which includes making context diagrams, ERD, TRD, DFD level 1, and SOP flow diagrams. Then design the system design.

System Requirements Analysis

1. Context Diagram

The context diagram shows the whole system in context with its environment. And shows the flow of data to and from external entities. Its purpose is to show all the major high-level processes of the system and how they are interrelated; all process models have only one level[9].

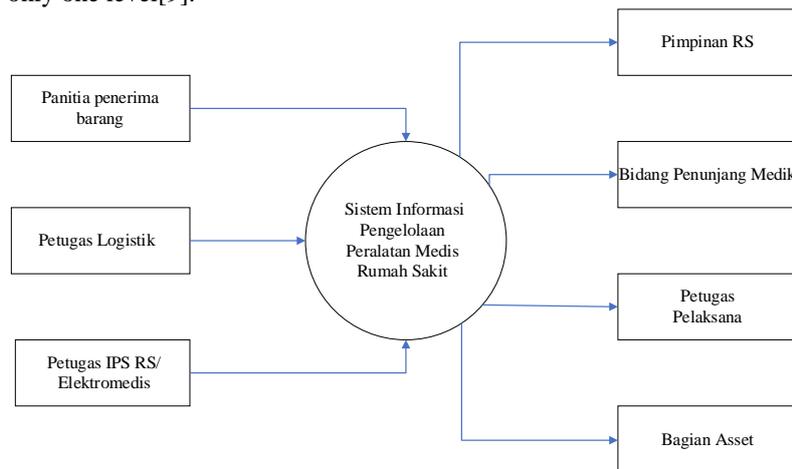


Figure 1. Context Diagram

This context diagram explains the relationship between the source entity and the destination entity, which is the source entity, and the data source will interact with the medical equipment management application system, namely the Goods Recipient Committee whose data sources are procurement data, logistics officers, and Home IPS officers. sick. Furthermore, there is the objective entity for the leadership of the hospital, the medical support sector, to see the availability of equipment in service units and their conditions, as material for planning proposals, implementing officers here are all hospital functional officers who can see the SOP video tutorial link for equipment during tool function testing, and then assets which can also view equipment reports.

2. Entity Relational Diagrams(ERD)

Entity relational diagrams are diagrams that are made to design tables that will be implemented in the database and also communicate the boundaries or guidelines that are followed during the operation of the system, describing the relationships between entities to show how they are related to one another. Like the following picture.

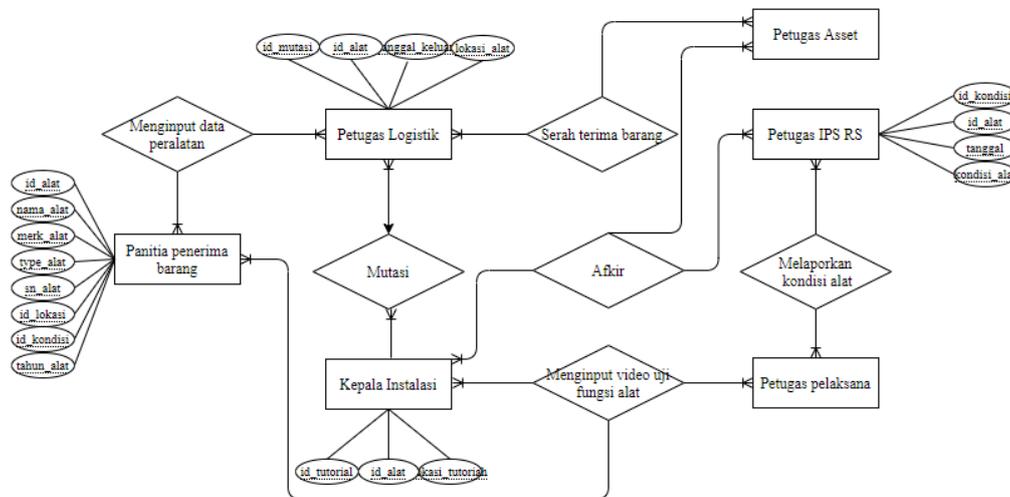


Figure 2. Entity Relational Diagram

In the ERD image above, it can be explained that there are several entities, namely the receiving committee, logistics officer, installation head, IPS RS officer, implementing officer, and asset officer. Furthermore, in the ERD image above there are also relations, namely inputting equipment data, handing over goods, transferring equipment, inputting videos of tool function tests, and reporting equipment conditions to the reject process.

3. Table Relationship Diagram

To better understand the entire process in the system, the database structure is described through a table relationship diagram (TRD) which consists of each database used to generate reports which can be seen in Figure 3 below. TRD describes the relationship between the main entities that exist in the database of equipment data input results, there are 6 tables with relationships between tables. After the goods handover process, medical equipment will be entered according to the attributes as shown in Figure 3, then managed by the system which is the equipment database. Equipment will also be directly entered according to the service unit that has been determined and the condition of the equipment. From the location table, it will provide database changes, as well as the condition table in the entry after there is a change then the system records and submits the database to the equipment data table which produces equipment data that shows what the equipment is and its conditions in each service unit. Likewise with the tutorial table, after being recorded it is then entered into a database on each piece of equipment.

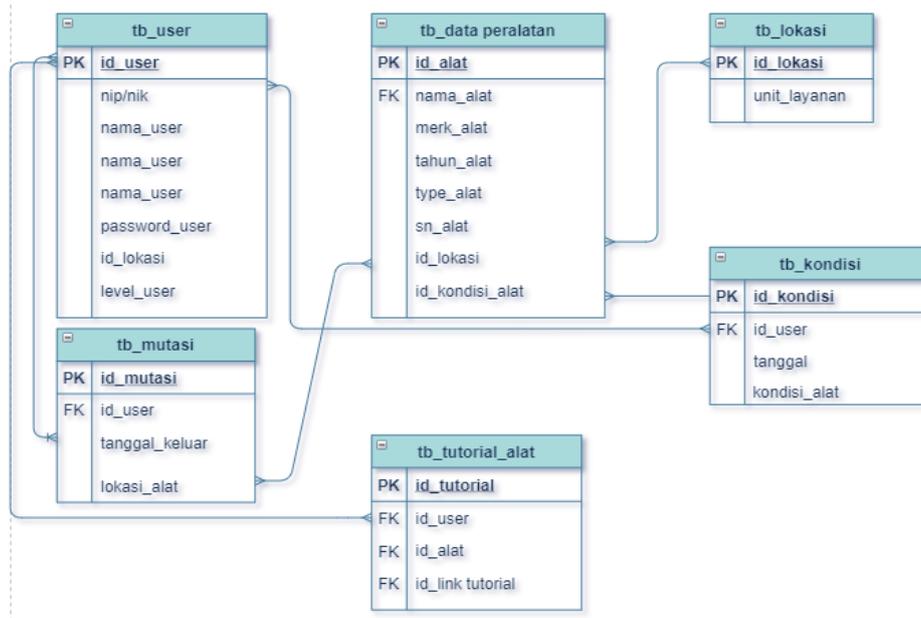


Figure 3. Table Relationship Diagram

4. Data Flow Diagrams(DFD) Level 1

Data flow diagrams or also known as data flow diagrams are diagrams that describe a system's data flow. The flow described is the input-process-output flow, which can be used to explain processes in the information system including the flow of information in and out of the system, all data entering and leaving each entity is the same as what is depicted in the context diagram.

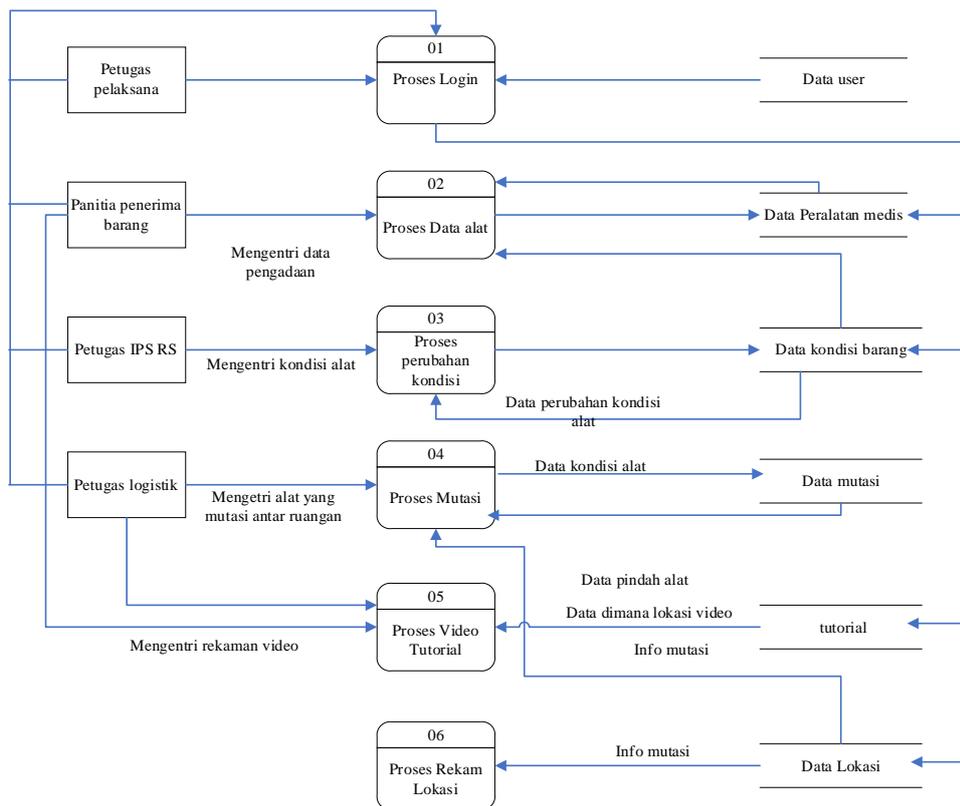


Figure 4. DFD Level 1

5. Standard Operational Procedure(SOP) Flow Diagrams.

Describe the business process of the hospital medical equipment management information system according to the diagram below: After the handover of the equipment after the procurement process, the admin of the receiving committee will input the medical equipment data with complete data along with the condition and location of the equipment, after that:

- At the time of utilization in the service unit, the equipment function test will be carried out and at that time the function test process will be recorded by the vendor technician. Then the recorded link will be input into the system by the admin.

- When the equipment is used then there is a report on the damage by the officer to the IPS RS section, then the IPS RS admin will enter a change in the condition of the equipment, then the report is followed up to carry out repair activities if it has been repaired and can be reactivated, the admin will re-enter the condition of the equipment and if it can't be repaired, it will be submitted to a rejection process.
- If there is a need for another process, the admin logistics officer will enter a change in the location of the equipment.

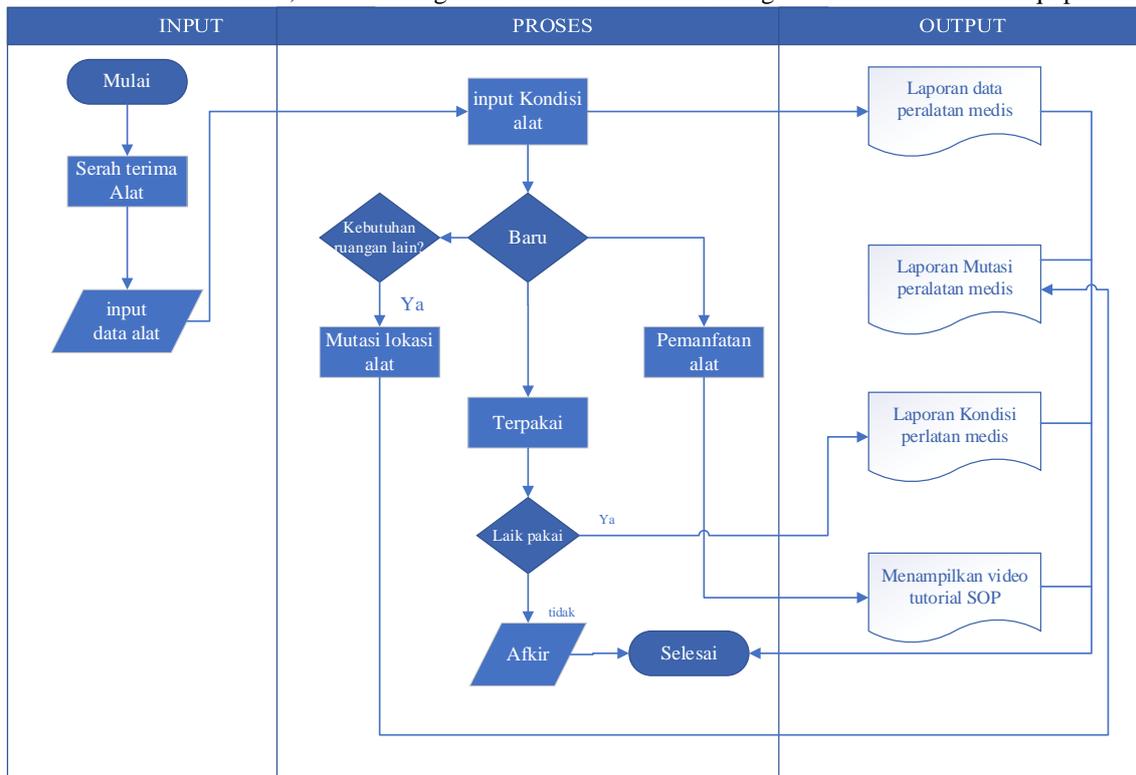


Figure 5. Flow Diagrams.

III. RESULTS AND DISCUSSION

Model Design Stages

The design of this hospital medical equipment management information system produces 2 types of applications, the first is for collecting data on an Android mobile information system that has a camera and the ability to connect to the internet, and the second is a web information system that is more monitoring in nature. This application is web-based with an internet network that is operated on a PC or mobile device by opening a browser as shown in Figure 6. A web application with screen display flexibility means that this application can display tables with more data.

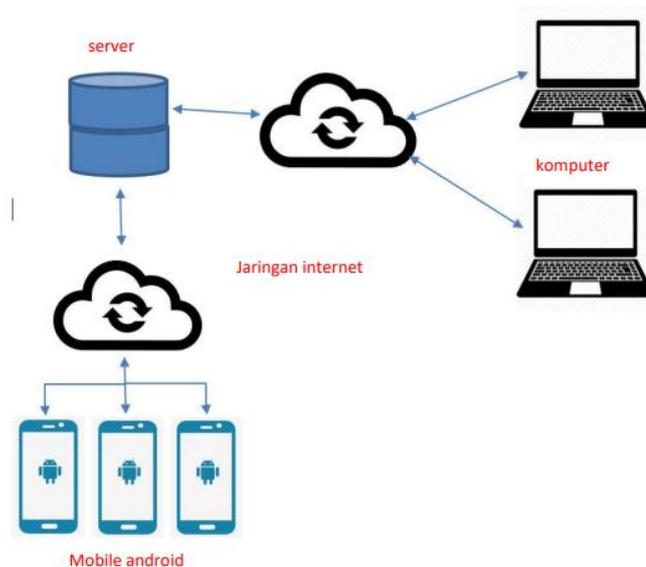


Figure 10. Architectural Concept

1. Mobile Application

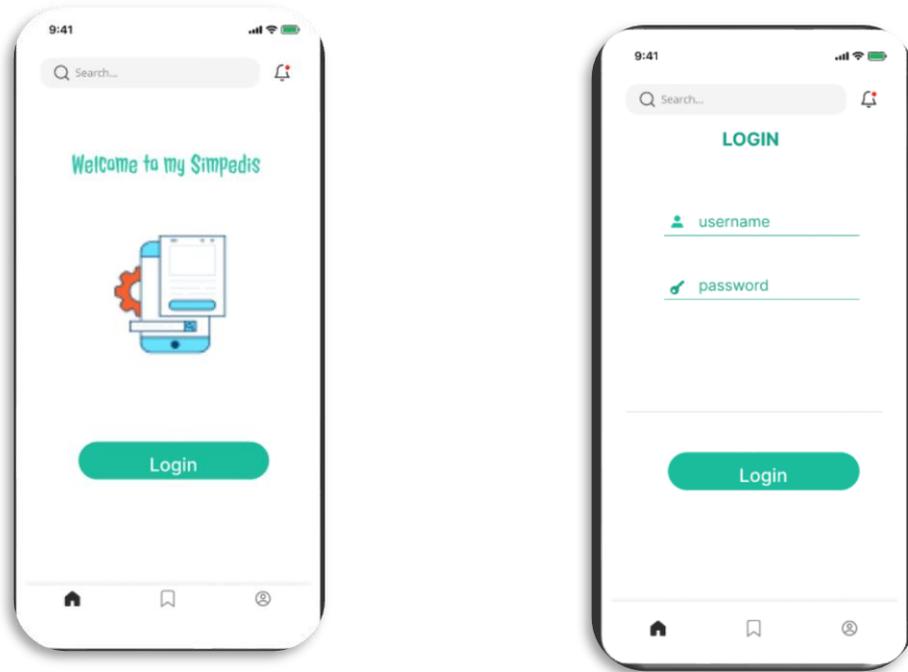


Figure 11. Front page Figure 12. Login page

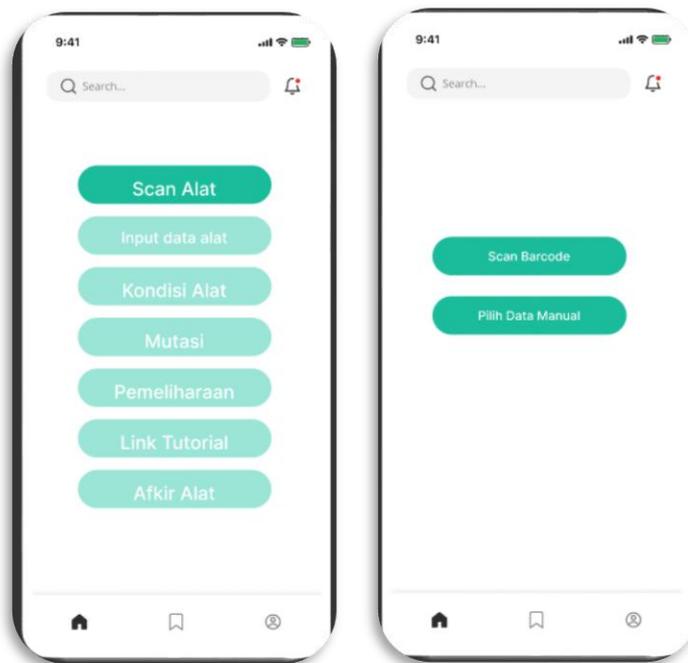


Figure 13. Menu Page Figure 14. Barcode Menu Page

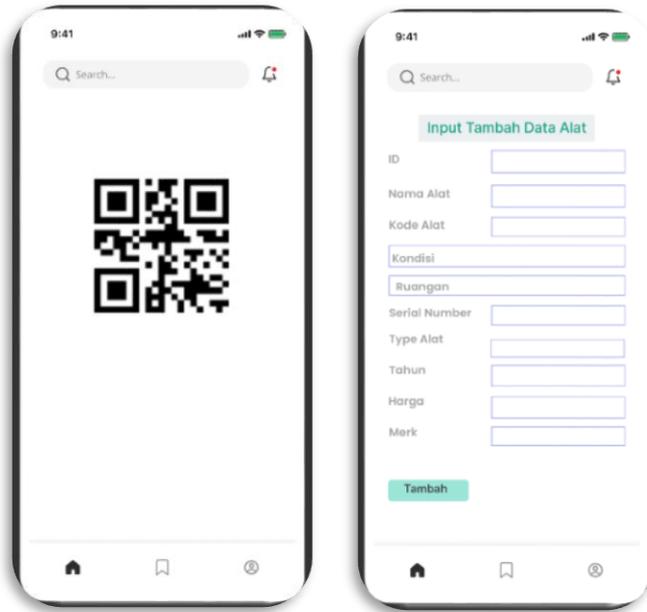


Figure 15. Barcode page Figure 16. Data input page

2. Web application

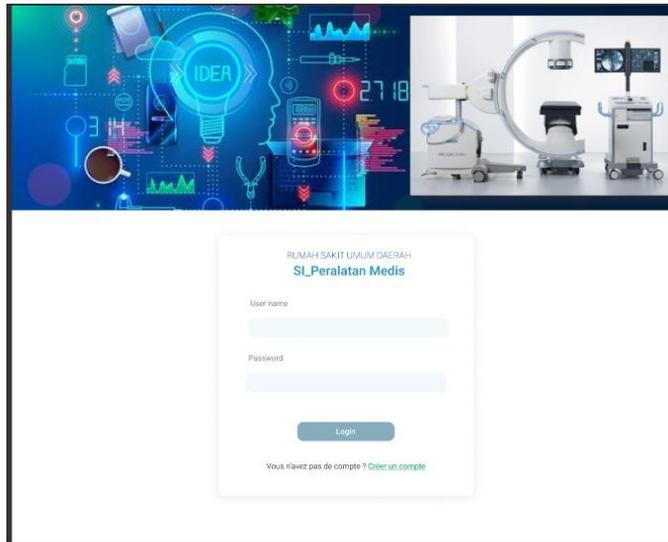


Figure 17. Web Login Page

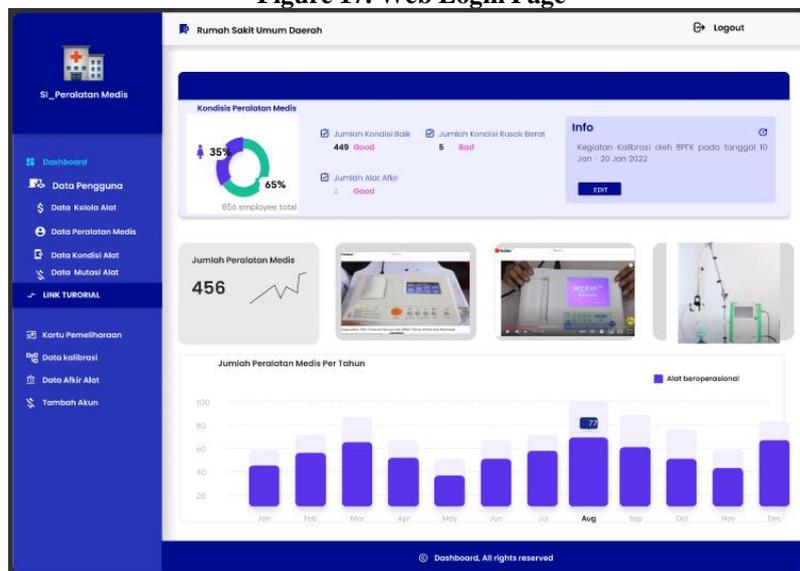


Figure 18. Dashboard page

No	Nama Alat	Merk	Type	SN	Tahun	Kondisi	Link
1.	EKG	Kenz	Cardio 305	2104	2022	B	https://www.youtube.com/watch?v=aRTQo3s_wbi0

Figure 19. Tutorial Link Menu page

No	Nama Alat	Merk	Type	SN	Lokasi	Tanggal	Kondisi	Aksi
1	ECG	Fuji	RT786	10872	UGD	21/12/2021	RB	

Figure 20. Condition menu page

IV. CONCLUSION

The design of this information system as a convenience for hospital management in managing medical equipment, is still in the prototype modeling stage and needs to be reviewed with users according to the needs of hospital management. This design produces a system model for hospital medical equipment management applications which are designed using a mobile application installed on Android for convenience in data collection and real-time data changes and also based on a web base system using a web browser as monitoring. . This system is a system that is used to facilitate marking of medical devices that have been inventoried in the form of QR barcodes, find out the number and condition of medical equipment in each service unit and also make it easy for hospital staff and technicians to be able to learn the correct operation of the equipment by viewing video tutorials on operating medical equipment as a translation of the operating manual. The development of this application is still in the system planning stage based on literature studies. The next stage needs to be carried out by analyzing user needs so as to produce applications that are in accordance with field needs.

REFERENCES

1. Republic of Indonesia Regulations. Law of the Republic of Indonesia Number 44 of 2009 About the Hospital . 2009;5(August):12–42.
2. ACCREDITATION REQUIREMENTS FOR ACUTE CARE HOSPITALS. 2017;
3. ministry of Health. Medical equipment management guidelines. 2012;(September):1–188.
4. Ministry of Health and Social Welfare of the Republic of Indonesia. Operational and Maintenance Guidelines for Medical Equipment (The Technical SOP and SMP of Medical Equipment). 2001;
5. Sherwin J. The essentials of medical device inventory tracking. Biomed Instrum Technol 2013;47(5):382–6.
6. Yoo S, Kim S, Kim E, Jung E, Lee KH, Hwang H. Real-time location system-based asset tracking in the healthcare field: lessons learned from a feasibility study. BMC Med Inform Decis Mak 2018;18(1):80.
7. Indonesian PMKR. Regulation of the Minister of Health of the Republic of Indonesia Number 56 of 2014 concerning Classification and Licensing of Hospitals [Internet]. 2014;
8. I. Harrington. Desi relational databasegn and implementation. 2009.
9. Dennis A, Wixom BH RR. System Analysis & Design 5th Edition. Danvers John Wiley Sons, Inc;2012;Fifth(Danvers John Wiley Sons, Inc;).