Jurnal Mantik, 7 (2) (2023), ISSN 2685-4236 (Online)

Published by:Institute of Computer Science (IOCS)

Jurnal Mantik

Journal homepage: www.iocscience.org/ejournal/index.php/mantik

Analysis and design of website-based hospital management information system applications

Helmina[1], Zulfikri Akbar[2], Muhammad Ikhsan[3], Rian Dani[4], Shandy Amandha[5]
[1,2,3,5] Faculty of Sains and Technology, Universitas Muhammadiyah Jambi, Jambi, Indonesia
[4]Faculty of Islamic Economic and Business, Universitas Islam Negeri STS Jambi, Jambi, Indonesia

A R T I C L E I N F O

Article history:

Received Jul 26, 2023
Revised Aug 02, 2023
Accepted Aug 03, 2023

Keywords:

Information System;
Management;
Waterfall Method.

ABSTRACT

This study aims to create a hospital management information system application, Hospital Management Information System (SIMRS), at KH Daud Arif Kuala Tungkal Hospital. Currently, KH Daud Arif Hospital in providing services are still carried out manually, starting from registration, meeting the doctor, and taking medicine, up to the payment/cashier stage, so it takes a long time, resulting in less than optimal completion of ongoing management. The method used is the Waterfall Method. This model provides a sequential approach to software life flow starting from the analysis, design, coding, testing and support stages. This Hospital Management Information System (RSIM) can increase the efficiency and effectiveness of hospital operations and assist in managing information and data related to patients, staff, and hospital activities. Also to optimize hospital operations, improve patient care, and provide greater benefits to medical staff, patients, and hospital management and can help automate and speed up hospital administration processes, such as patient registration, appointment scheduling, payments, and inventory management.

Corresponding Author:

Helmina,
Faculty of Sains and Technology,
Universitas Muhammadiyah Jambi.
Jln. Kapt. Pattimura Simp. IV Sipin Jambi, 36124, Indonesia,
Email: baehelmina@gmail.com.

1. INTRODUCTION

Information technology is developing rapidly, so all business fields use it to manage their business fields. Information technology is becoming a basic requirement for improving organizational or company performance because business competition is getting tougher (Atmaja, H. E., 2018). In achieving its goals, it always faces obstacles such as inadequate information systems and technology used. Therefore, every obstacle that arises must be overcome so that the company can minimize the risks. Hospitals are important to health services (Fajriansyah, M., Muchsin, S., & Suyeno, 2022).

Hospitals have the functions and objectives of health service facilities that carry out service activities in outpatient, inpatient, emergency, and referral services (Wijaya, A. P., & Vera, 2021). Hospitals must always improve service quality to customer expectations to increase service user satisfaction (Elizar et al., 2020; Gonzalez, 2019; Sitio & Ali, 2019). To succeed in hospital management, it must have a Management Information System that

can assist the business processes within it (Handiwidjojo, 2015). Management information systems have an important meaning for a company supported by advances in information technology which aims to provide information for company managers, improve existing information systems and improve internal control of related functions (He et al., 2021; Rainer & Prince, 2022; Tallon et al., 2019). RSUD KH. DAUD ARIF KUALA TUNGKAL is the ONLY HOSPITAL in Kuala Tungkal, West Tanjung Jabung Regency, Jambi Province. The task is to serve the community and ensure public health in the district. At present, the KH Daud Arif Hospital in providing services is still carried out manually, starting from registration, meeting the doctor, and taking medicine, to the payment/cashier stage, so it takes a long time, and the process is too wordy, which results in less than optimal management completion. The problems encountered a touch of technology is needed to help solve these problems by creating a hospital management information system application; the Hospital Management Information System (SIMRS) is a series of activities that cover all health services (hospitals) at all levels of administration that can provide information to managers for management processes (related to data collection, data processing, information presentation and analysis) of health services in hospitals (Setyawan, 2016). The role of information systems in hospital management activities is very helpful and has a very effective role in the process of health services in hospitals; with an information system, a hospital leader can make a policy quickly, precisely and accurately based on information obtained from health services at home the pain he leads (Yamin, 2018).

2. RESEARCH METHOD

This research was conducted at KH Daud Arif Kuala Tungal Hospital, West Tanjung Jabung Regency, Jambi Province. The method used is the Waterfall Model. This model provides a sequential approach to software life flow starting from analysis, design, coding, testing and support stages. The waterfall method can be seen in the following figure:

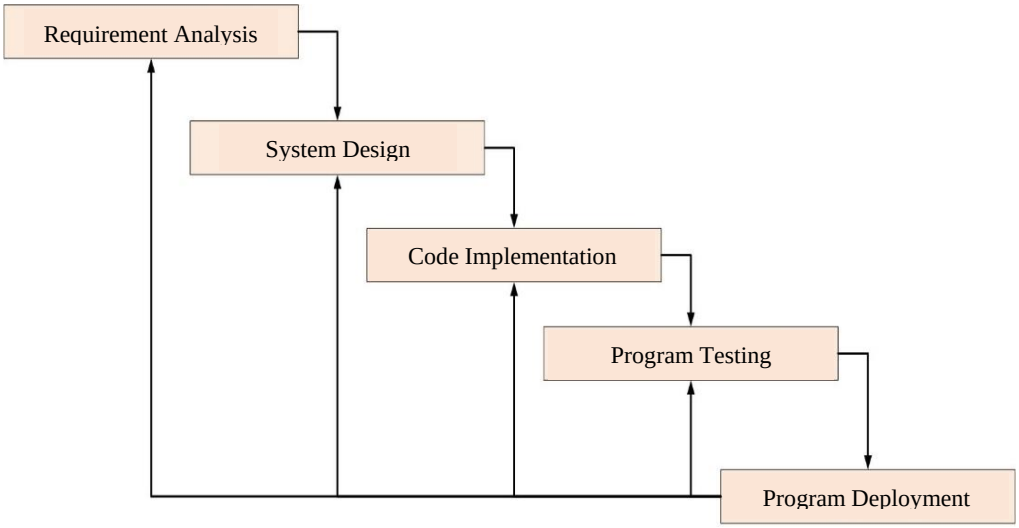

Figure 1. The Waterfall Method

Needs Analysis

At this stage, the developer must know all the information about software requirements, such as the usability of the software desired by the user and the limitations of the software. This information is usually obtained from interviews, surveys, or

discussions (Muhammad, 2022). After that, the information is analyzed to obtain complete data regarding user needs for the software to be developed (Samsuni, S., & Erfiyani, 2018).

System Design

The next stage is Design. Design is done before the coding process begins. It aims to provide a complete picture of what needs to be done and what the desired system looks like (Aminah, S., Bhaskoro, S. B., & Sunarya, 2020). So that it helps specify hardware and system requirements and defines the system architecture that will be made as a whole (Segovia, M., & Garcia-Alfaro, 2022).

Code Writing

The code-writing process is at this stage. Making software will be broken down into small modules, which will later be combined in the next stage (Safitri, S. T., & Supriyadi, 2015). In this stage, a deeper examination will also be carried out on the module that has been made and whether it has fulfilled the desired function.

Program Testing

In this fourth stage, the modules that have been made before will be combined.After that, testing will be carried out to determine whether the software is according to the desired design and whether there are still errors or not (Sumilat, 2022).

Program Implementation

Program implementation is the final stage of the waterfall development method (Al-Saqqa et al., 2020; Firmansyah, 2017; Thesing et al., 2021). Here the finished software will be run or operated by its users. In addition, maintenance is also carried out, which includes: (a). Bug fixes; (b). Improvement of system unit implementation; (c). Improvement of system services according to new requirements.

3. RESULTS AND DISCUSSIONS

Table 1. Application of the hospital management information system (SIMRS) waterfall method

No	Stages	Description
1	Reason for using Waterfall	Because the needs of the Hospital are very clear.
2	Analysis	Needs analysis is carried out by interviewing the Head of Services and obtaining data about the Hospital from the interviews.
3	Design	System design using ERD, such as Use Cases, Activity Diagrams, Class Diagrams, Object Diagrams, Component Diagrams, and Deployment Diagrams.
4	Implementation	The information system will be created using the PHP programming language with HTML, CSS, Bootstrap and CodeIgniter frameworks.
5	System Testing	Testing is done on functionality to information system experts, administrators and Direct Patients.
6	Maintenance	Maintenance will be carried out if there is a feature update or fixes errors found when the system is used directly by the user.

Use Case Diagram SIMRS Application

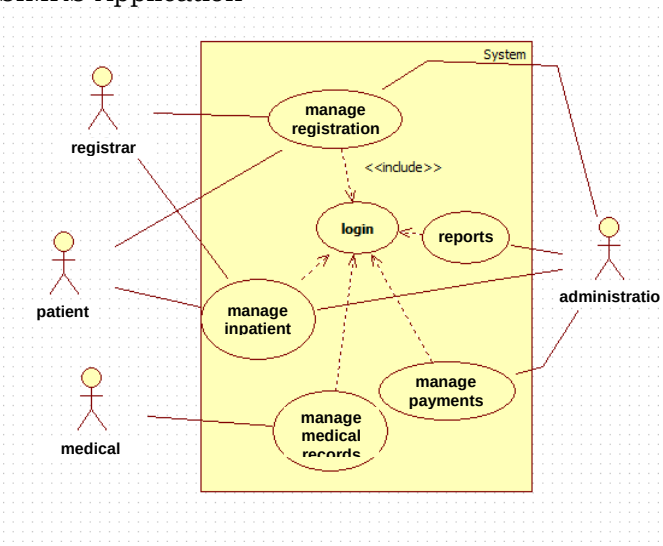

Figure 2. Use case diagram SIMRS application

Use case identification and Proposed Description

Table 2. Use case identification and description

No	Use Case	Description
1	Login	Determine user access rights when entering the system.
2	Manage Master data	Functional to input or change master data.
3	Manage Registration	Functional to input patient data registration new.
4	Manage Administration	Functional to make administrative fee payments the first time you register.
5	Manage Hospitalization	Functional for inputting patient data on hospitalization at the clinic.
6	Manage Payments	Functional to record patient inpatient payment data at the clinic.
7	Manage Medical Records	Functional to record examination data, patient progress and drugs are given.
8	Report	Functional displays report.

Actor Identification and Proposed Description

Table 3. Identification of actors and descriptions

No.	Actor	Description
1	Administration	System users who can perform processing master data, registration and payment.
2	Registration	System users who manage patient registration new admissions and inpatient admissions.
3	Medical Officer	System users who input patient medical recaps.
4	Patient	The external entity, which performs the physical activity.

Activity Diagram Login

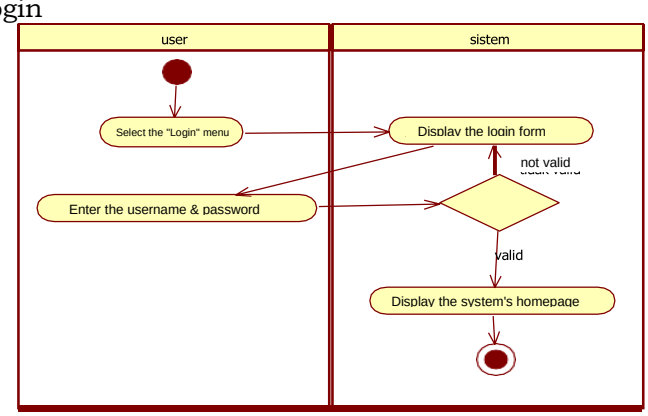

Figure 3. Proposed Login Activity Diagram

Activity Diagram Managing Master Data

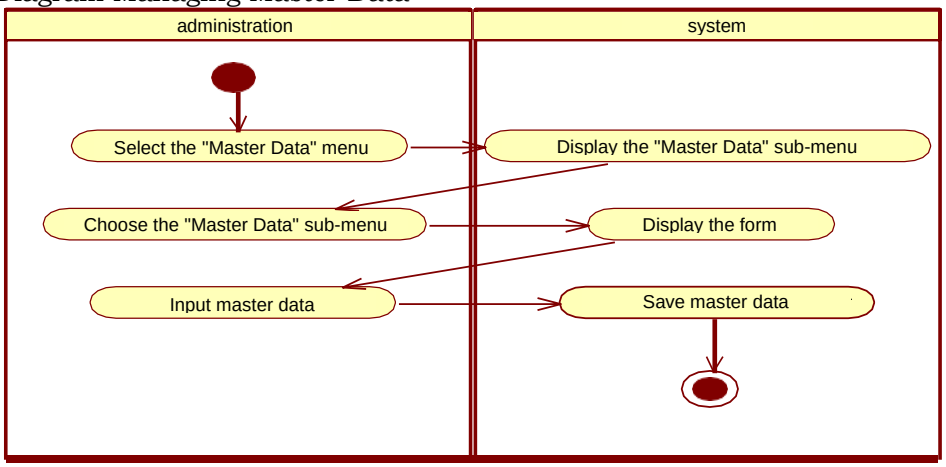

Figure 4. Activity Diagram Managing Proposed Master Data

Activity Diagram Managing Registration

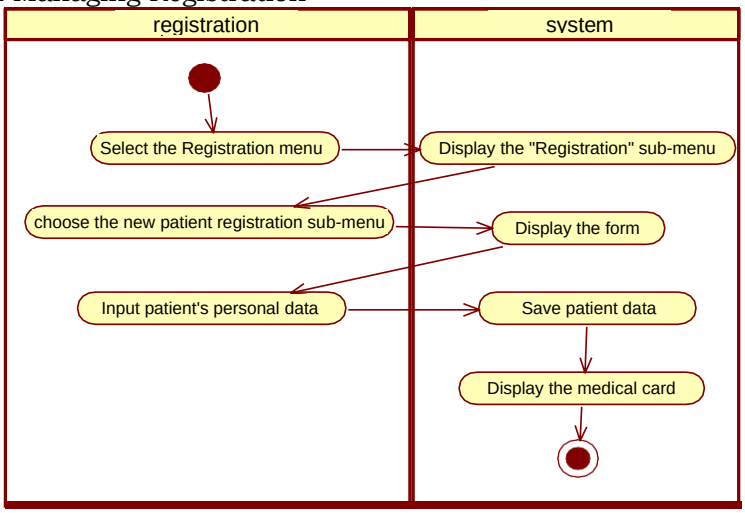

Figure 5. Activity Diagram Manage the Proposed registration

Activity Diagram Managing Administration

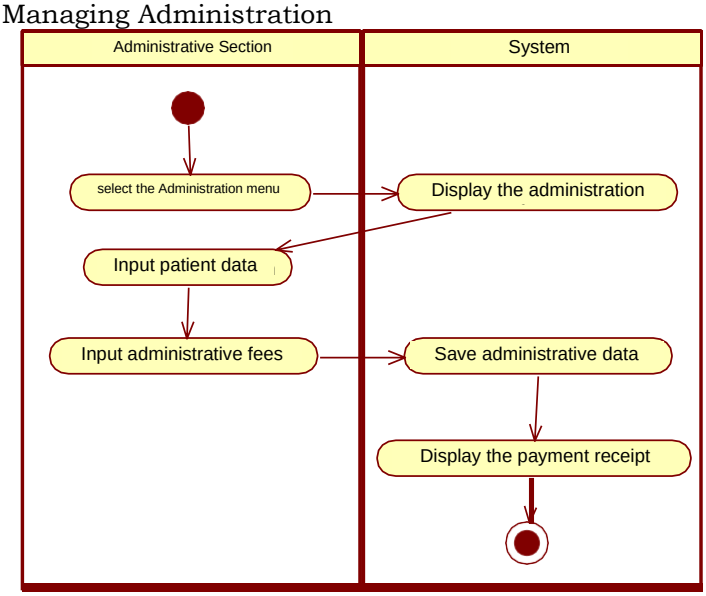

Figure 6. Activity Diagram Managing the Proposed Administration

Activity Diagram of Managing Hospitalization

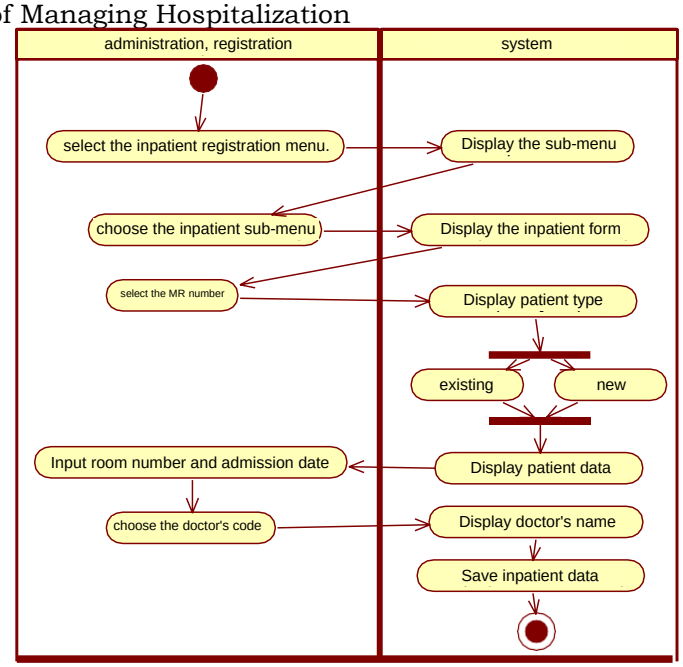

Figure 7. Activity Diagram Managing Proposed Hospitalization

Activity Diagram Managing Medical Records

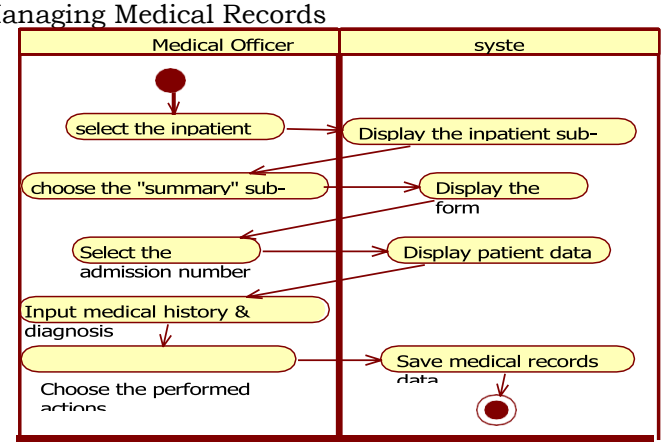

Figure 8. Activity Diagram of Managing Proposed Medical Records

Activity Diagram Managing Payments

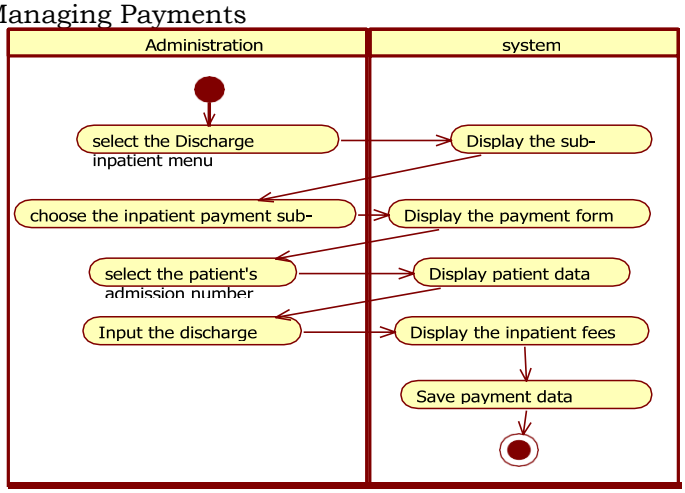

Figure 9. Activity Diagram Managing Proposed Payments

Activity Diagram Report

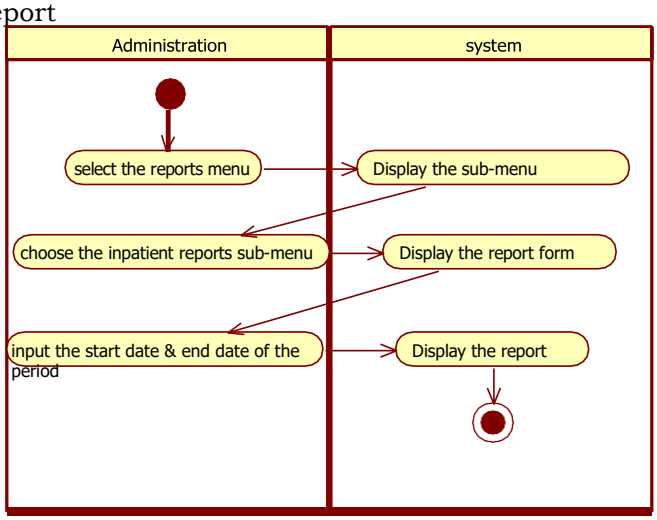

Figure 10. Activity Diagram of the Proposed Report

Class Diagram

Class diagrams display classes and packages in the system (Puspita, D., & Aminah, 2018). Class diagrams provide a static picture of the system and the relationships between them. By looking at the characteristics of the system and the processes that occur, class diagrams can be made as follows:

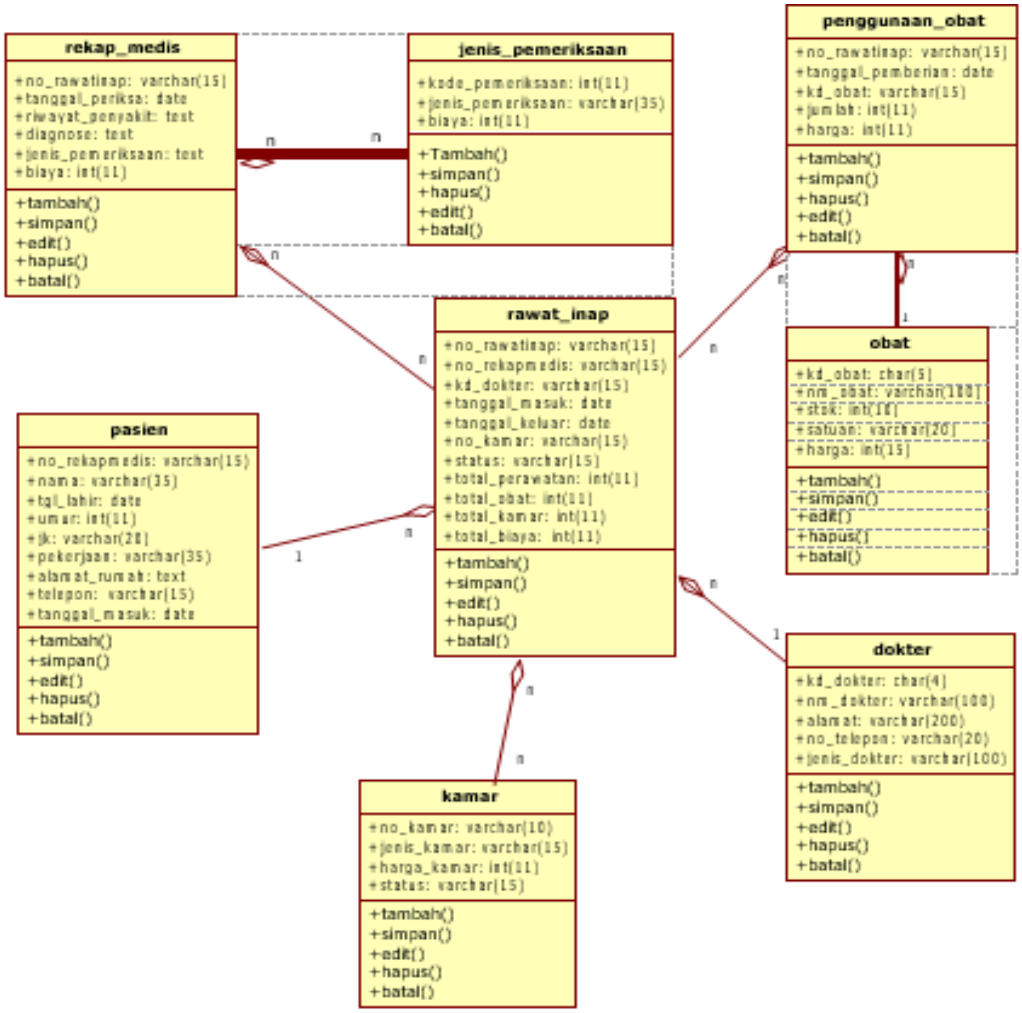

Figure 11. Proposed class diagram

Object Diagram

Object diagrams describe the system's structure in terms of naming objects and the course of objects in the system (Aprianti, W., & Maliha, 2016). The following is an object diagram of the proposed system.

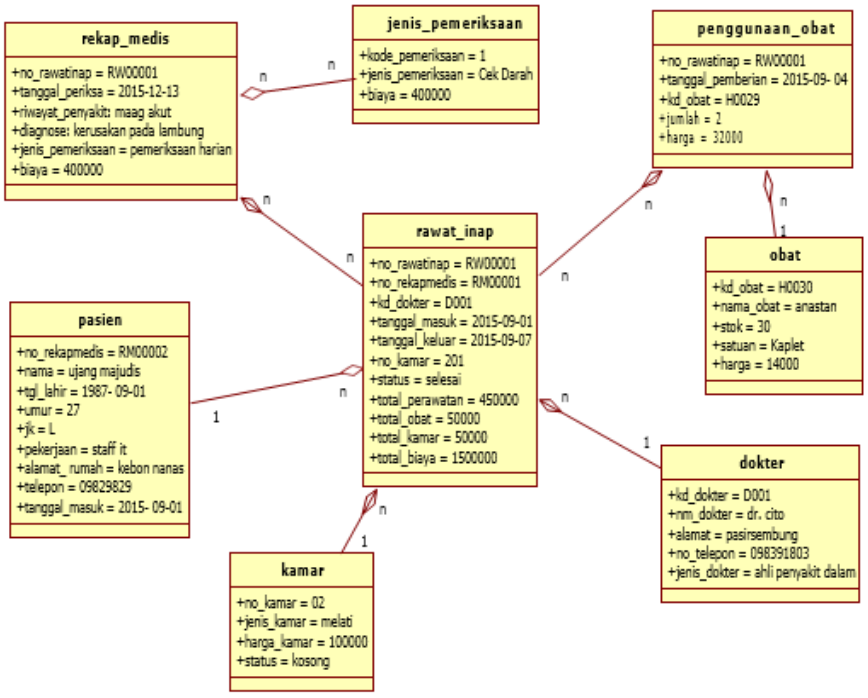

Figure 12. Proposed object diagram

Component Diagram

Component diagrams describe the structure and relationships between software components (Siregar, H. F., Siregar, Y. H., & Melani, 2018). The component diagram proposed in the Cito Clinical Information System is as follows:

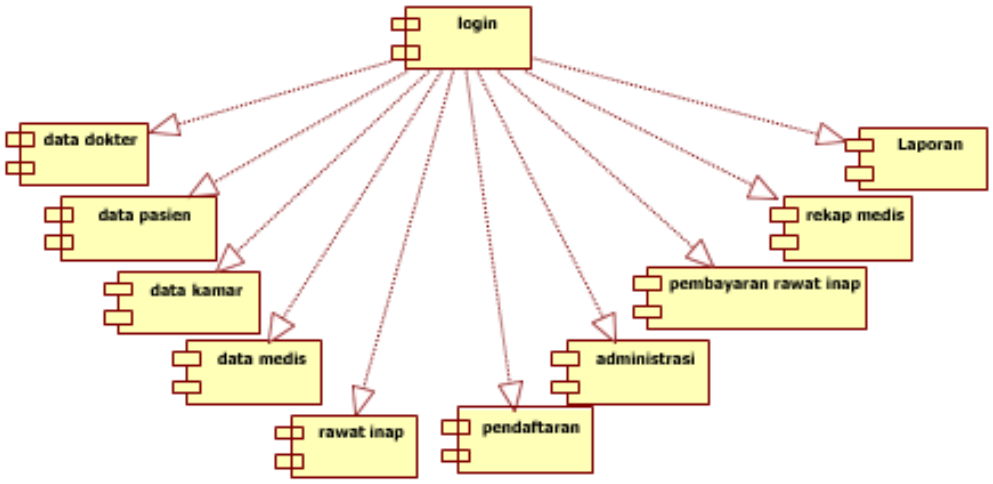

Figure 13. The proposed component diagram

Deployment / physical diagrams describe how components are deployed in the system infrastructure, where the components will be located (on what machine, server or hardware), how the network capabilities at that location, server specifications, and other physical things. A node is a server, workstation, or other hardware used to deploy components in a real environment. This diagram can also define relationships between nodes (e.g. TCP/IP) and requirements.

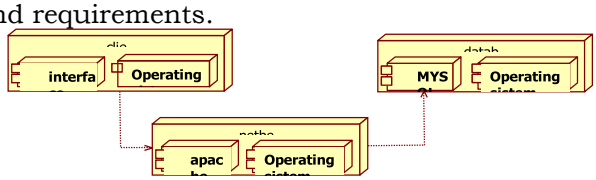

Figure 14. Proposed deployment diagram

Implementation Stage

Login Page

Login is the initial step to being able to run an application; with a login, it is possible that other people cannot access the application (Abdel Hameed, M., Hassaballah, M., Hosney, M. E., & Alqahtani, 2022).

Figure 15. Login page

Main Menu Page

The menu page is a source of information about the contents of this application. And it is a consideration for the user regarding what needs/information will be selected when opening this application (Zardecki, C., Dutta, S., Goodsell, D. S., Lowe, R., Voigt, M., & Burley, 2022).

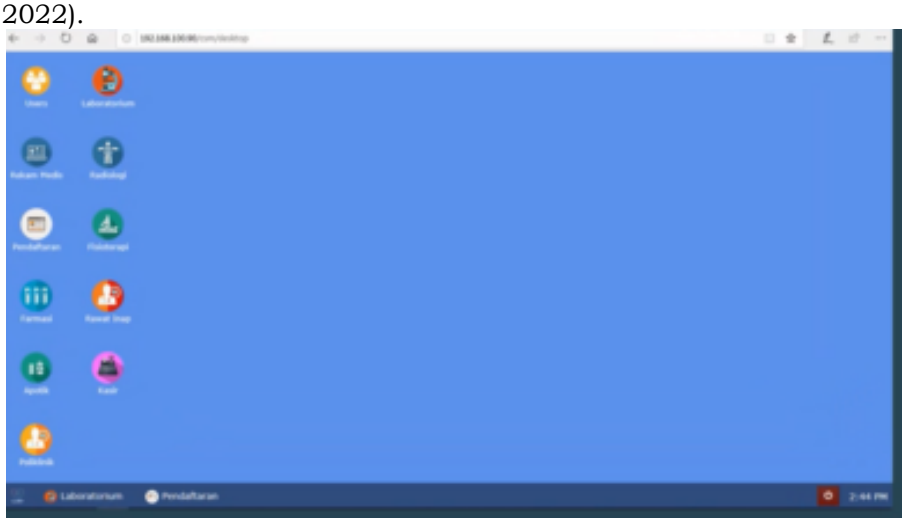

Figure 16. Main menu page

Polyclinic page

This polyclinic page displays patient data that is or is being treated at a general poly (Laia, O., Nasution, S. L., & Ginting, 2023).

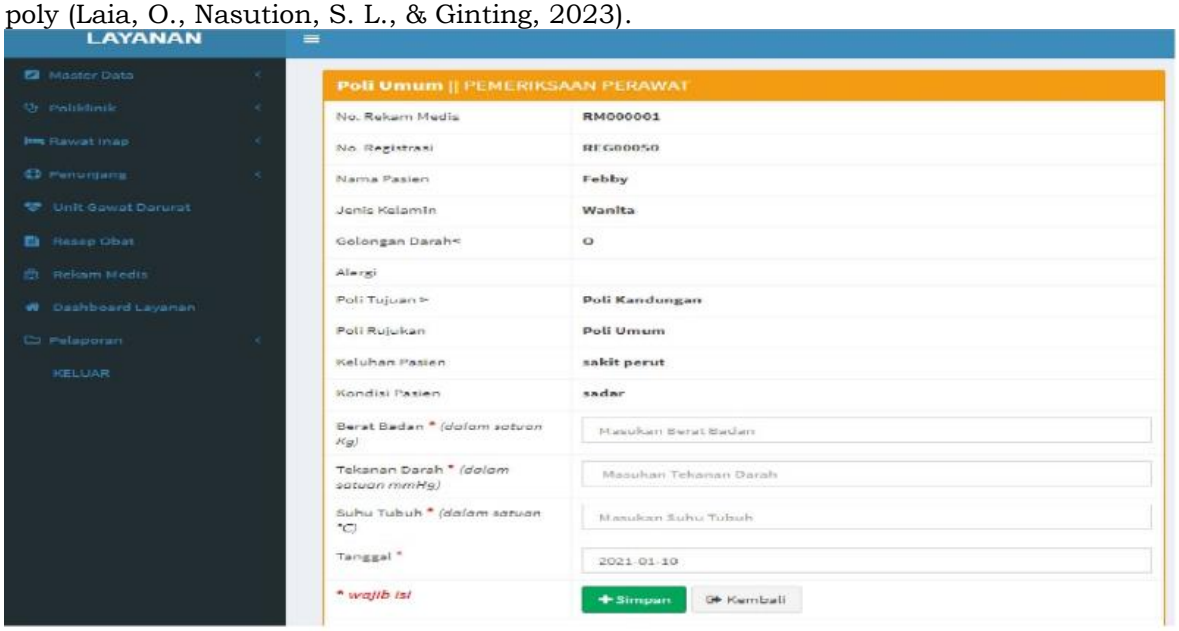

Figure 17. Polyclinic page

UGD Page

This ER page displays patient data that is or is being treated at the ER (Fisher, M., & Savitz, 2022).

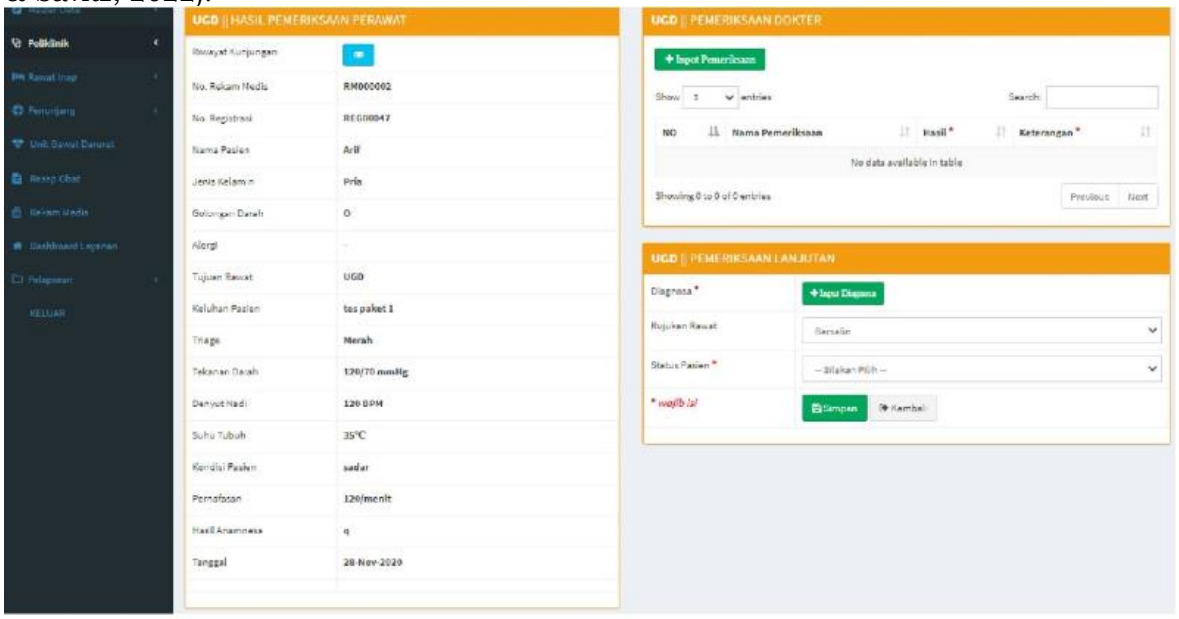

Figure 18. UGD Page

Inpatient Page

The Inpatient page is a page that displays records that are used to monitor the patient's condition when they enter the Inpatient Room, Hospital Internal Transfers until the patient leaves the hospital, detailing the types of services available (Haimovich, A. D., Xu, W., Wei, A., Schonberg, M. A., Hwang, U., & Taylor, 2023).

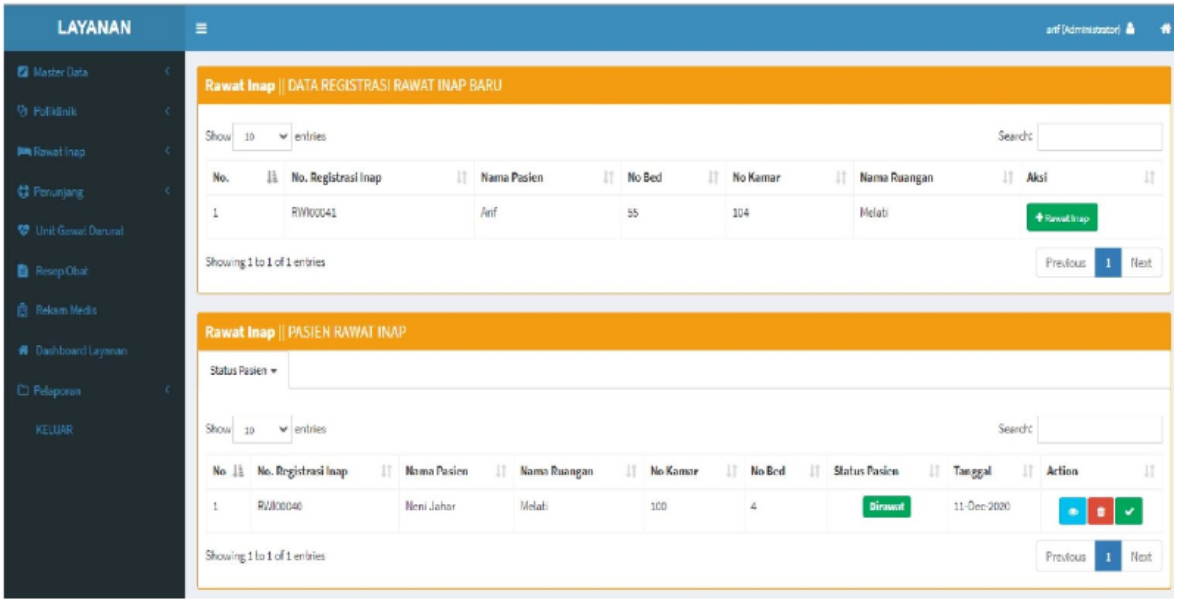

Figure 19. Inpatient page

Medication Prescription Page

This Drug Prescription page displays patient data, doctor data and data on medicines that will be given to patients; then, from this data, the pharmacy staff will prepare medicines to be given to patients; this page will also be directly connected with the cashier for the finance section (El Khatib, M., Hamidi, S., Al Ameeri, I., Al Zaabi, H., & Al Marqab, 2022).

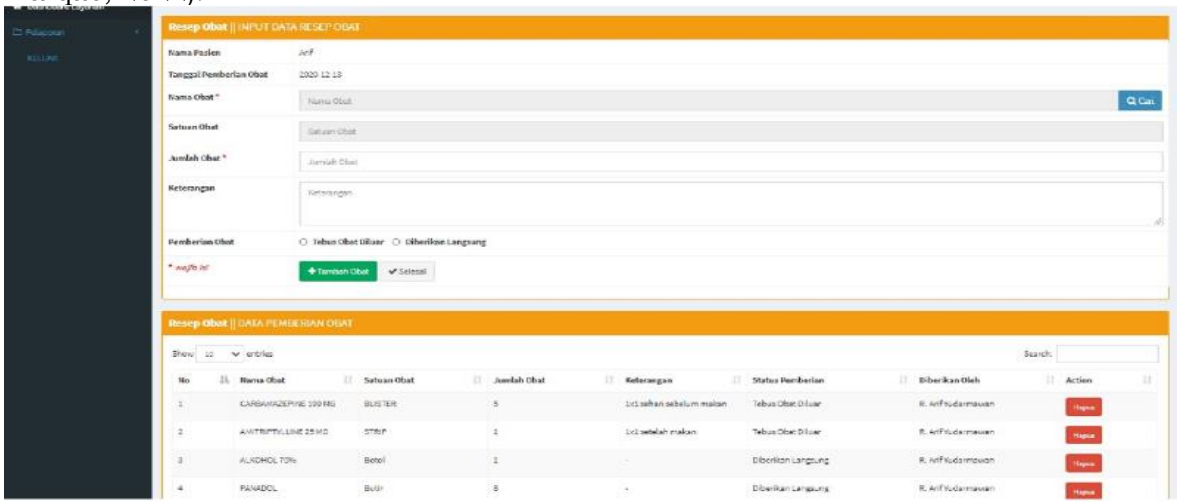

Figure 20. Medication prescription page

Medical Record Page

The Medical Record page is the basis of a Hospital Management Information System (SIMRS) because it is the basis for patient care and treatment, evidence in legal cases, material for research and education, the basis for paying health care costs and preparing health statistics (Nelson, C. A., Bove, R., Butte, A. J., & Baranzini, 2022).

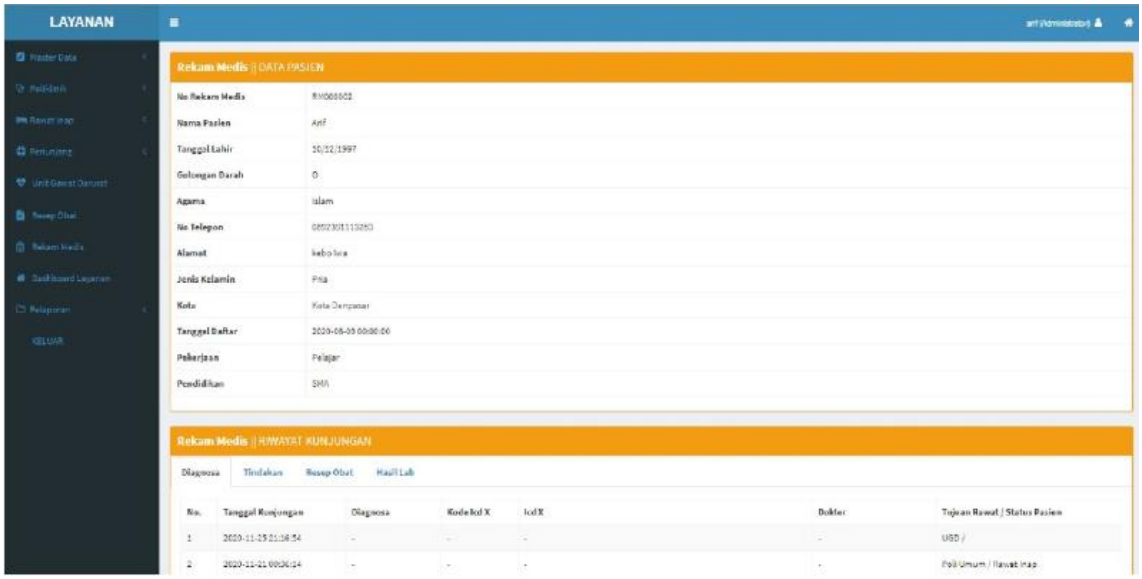

Figure 21. Medical record page

Test result

Several cases and test results that have been carried out on the SIMRS Application at KH Daud Arif Hospital are as follows:

Tabel 4. Login data testing and master data testing

Cases and Test Results (Normal Data)			
Data Input	Expected	Observation	Conclusion
Administration Access Username: b Password: b	The login is successful and displays the system page.	The login is successful and displays the system page.	(V) Accepted ( ) Rejected
Access to medical personnel Username : c Password : c	The login is successful and displays the system page.	The login is successful and displays the system page.	(V) Accepted ( ) Rejected
Cases and Test Results (Invalid Data)			
Data Input	Expected	Observation	Conclusion
Registration Access Username : a Password : b	Login failed and an error message appears	Login failed and an error message appears	(V) Accepted ( ) Rejected
Adminitration Access Username : b Password : a	Login failed and an error message appears	Login failed and an error message appears	(V) Accepted ( ) Rejected
Cases and Test Results (Normal Data)			
Data Input	Expected	Observation	Conclusion
Fill out the drug data form	A successful save message appears, and the database is added.	A successful save message appears, and the database is added.	(V) Accepted ( ) Rejected
Edit doctor data	A successful edit message appears, and the data changes.	A successful edit message appears, and the data changes.	(V) Accepted ( ) Rejected
Cases and Test Results (Invalid Data)			
Data Input	Expected	Observation	Conclusion
Enter the doctor's telephone number in letters.	The error message "fill in numbers" appears.	The error message "fill in numbers" appears.	(V) Accepted ( ) Rejected
Fill in the inspection price with letters.	The error message "fill in numbers" appears.	The error message "fill in numbers" appears.	(V) Accepted ( ) Rejected

4. CONCLUSION

The existence of SIMRS can increase the efficiency and effectiveness of hospital operations and assist in managing information and data related to patients, staff, and hospital activities as a whole. To optimize hospital operations, improve patient care, and provide greater benefits to medical staff, patients, and hospital management.This application can help automate and speed up hospital administrative processes, such as patient registration, scheduling appointments, payments, and inventory management. This reduces the time and effort required in administrative tasks, thereby increasing overall operational efficiency.Using a hospital management information system application, hospitals can optimize their operations, improve the quality of patient care, provide significant benefits for medical staff patients, and improve Data Security. For future research development related to SIMRS and health systems in general, some suggestions that can be considered are to conduct further research to evaluate the implementation and use of SIMRS in various hospitals. This research could involve analyzing user satisfaction, operational efficiency, quality of patient care, and financial impact after adopting the system. On the aspect of data security and privacy in SIMRS. Focus on identifying and addressing potential vulnerabilities, protection against cyber-attacks, and optimizing encryption systems and access to sensitive patient data. Conduct research on the integration of SIMRS with other health systems, such as laboratory systems, pharmacy systems, and other third-party systems. This research can help ensure smooth data transfer and avoid errors or information redundancy. Application of advanced technologies, such as artificial intelligence (AI) and data analytics, to improve the ability of SIMRS to analyze patient data, detect patterns, and provide valuable guidance in medical decision-making. The effective use of SIMRS in disease outbreak control and response, especially in health emergencies or disasters. Simulations and case studies can help provide guidance on how SIMRS can be optimally used in these scenarios. Many current studies focus on large hospitals or government hospitals. Therefore, further research should be conducted to understand the challenges and benefits of SIMRS implementation in small and medium-sized hospitals that may have limited resources and technological infrastructure. SIMRS as a tool to increase patient participation in their own health management. Increasing information transparency and empowering patients to access their data can improve informed health decision-making. The financial impact of using SIMRS in the long term. This study can help identify potential long-term cost savings and financial benefits resulting from the implementation of this system.

REFERENCES

Abdel Hameed, M., Hassaballah, M., Hosney, M. E., & Alqahtani, A. (2022). An AI-enabled internet of things based autism care system for improving cognitive ability of children with autism spectrum disorders. *Computational Intelligence and Neuroscience*, *1*.

Al-Saqqa, S., Sawalha, S., & AbdelNabi, H. (2020). Agile software development: Methodologies and trends. *International Journal of Interactive Mobile Technologies*, *14*(11).

Aminah, S., Bhaskoro, S. B., & Sunarya, A. S. (2020). Desain dan Implementasi Aplikasi Inventaris Alat Praktikum Pada Laboratorium Berbasis Android dan QR Code. *In Prosiding Seminar Hasil Penelitian Dan Pengabdian Kepada Masyarakat Unjani Expo (Unex)*, *1*(1), 91–95.

Aprianti, W., & Maliha, U. (2016). Sistem Informasi Kepadatan Penduduk Kelurahan Atau Desa Studi Kasus Pada Kecamatan Bati-Bati Kabupaten Tanah Laut. *Jurnal Sains Dan Informatika*, *2*(1).

El Khatib, M., Hamidi, S., Al Ameeri, I., Al Zaabi, H., & Al Marqab, R. (2022). Digital disruption and big data in healthcare-opportunities and challenges. *ClinicoEconomics and Outcomes Research*, *1*, 563–574.

Elizar, C., Indrawati, R., & Syah, T. Y. R. (2020). Service quality, customer satisfaction, customer trust, and customer loyalty in service of Paediatric Polyclinic over Private H Hospital of East Jakarta, Indonesia. *Journal of Multidisciplinary Academic*, *4*(2), 105–111.

Fajriansyah, M., Muchsin, S., & Suyeno, S. (2022). Implementasi Pelayanan Badan Penyelenggara

Jaminan Sosial (BPJS) Kesehatan (Studi Kasus tentang Pelayanan BPJS Kesehatan di Rumah Sakit Islam Unisma Malang). *Respon Publik*, *16*(1), 85–92.
Firmansyah, Y. (2017). Penerapan Metode SDLC Waterfall Dalam Pembuatan Aplikasi Pelayanan Anggota Pada CU Duta Usaha Bersama Pontianak. *Bianglala Informatika*, *5*(1), 53–61.
Fisher, M., & Savitz, S. I. (2022). Pharmacological brain cytoprotection in acute ischaemic stroke—renewed hope in the reperfusion era. *Nature Reviews Neurology*, *18*(1), 193–202.
Gonzalez, M. E. (2019). Improving customer satisfaction of a healthcare facility: reading the customers' needs. *Benchmarking: An International Journal*, *26*(3), 854–870.
Haimovich, A. D., Xu, W., Wei, A., Schonberg, M. A., Hwang, U., & Taylor, R. A. (2023). Automatable end-of-life screening for older adults in the emergency department using electronic health records. *Journal of the American Geriatrics Society*, *71*(1), 1829–1839.
Handiwidjojo, W. (2015). Sistem informasi manajemen rumah sakit. *Jurnal Eksplorasi Karya Sistem Informasi Dan Sains*, *2*(1).
He, W., Zhang, Z. J., & Li, W. (2021). Information technology solutions, challenges, and suggestions for tackling the COVID-19 pandemic. *International Journal of Information Management*, *57*, 102287.
Laia, O., Nasution, S. L., & Ginting, J. (2023). Evaluation Of The Implementation Of Primary Care (P-Care) Application At Puskesmas Onolalu Nias Selatan In 2022. *International Journal of Health and Pharmaceutical (IJHP)*, *3*(1), 629–636.
Muhammad, A. N. (2022). *Sistem Informasi Peminjaman Ruang Rapat (M-Rapat) Pada Dinas Komunikasi dan Informatika Kabupaten Probolinggo*. *1*.
Nelson, C. A., Bove, R., Butte, A. J., & Baranzini, S. E. (2022). Embedding electronic health records onto a knowledge network recognizes prodromal features of multiple sclerosis and predicts diagnosis. *Journal of the American Medical Informatics Association*, *29*(1), 424–434.
Puspita, D., & Aminah, S. (2018). Sistem Informasi Manajemen Kewirausahaan Pedesaan Berbasis Web Multimedia. *In Seminar Nasional Teknologi Informasi Dan Komunikasi (SEMNASTIK)*, *1*(1), 626–631.
Rainer, R. K., & Prince, B. (2022). *Introduction to information systems: Supporting and transforming business*. John Wiley & Sons.
Safitri, S. T., & Supriyadi, D. (2015). Rancang bangun sistem informasi praktek kerja lapangan berbasis web dengan metode waterfall. *Jurnal Infotel*, *7*(1), 69–94.
Samsuni, S., & Erfiyani, E. (2018). Rancang Bangun Aplikasi E-Commerce Penjualan Produk Kecantikan Dan Fashion Pada AC Fashion Style. *PROSISKO: Jurnal Pengembangan Riset Dan Observasi Sistem Komputer*, *5*(1).
Segovia, M., & Garcia-Alfaro, J. (2022). Design, modeling and implementation of digital twins. *Sensors*, *22*(1).
Setyawan, D. (2016). Analisis Implementasi Pemanfaatan Sistem Informasi Manajemen Rumah Sakit (Simrs) Pada Rsud Kardinah Tegal. *IJCIT (Indonesian Journal on Computer and Information Technology)*, *1*(1).
Siregar, H. F., Siregar, Y. H., & Melani, M. (2018). Perancangan Aplikasi Komik Hadist Berbasis Multimedia. *(JurTI) Jurnal Teknologi Informasi*, *2*(1), 113–121.
Sitio, T., & Ali, H. (2019). Patient Satisfaction Model and Patient Loyalty: Analysis of Service Quality and Facility (Case Study at Rawamangun Special Surgery Hospital). *Scholars Bulletin*, *5*(10), 551–559.
Sumilat, J. M. (2022). *The Utilization of Online Media in Calculation Operations Mathematics Learning in Elementary School Students*. *1*.
Tallon, P. P., Queiroz, M., Coltman, T., & Sharma, R. (2019). Information technology and the search for organizational agility: A systematic review with future research possibilities. *The Journal of Strategic Information Systems*, *28*(2), 218–237.
Thesing, T., Feldmann, C., & Burchardt, M. (2021). Agile versus waterfall project management: decision model for selecting the appropriate approach to a project. *Procedia Computer Science*, *181*, 746–756.
Wijaya, A. P., & Vera, O. (2021). Analisa dan Perencanaan Sistem Informasi Rekam Medis Pada Fasilitas Kesehatan. *Jurnal Ilmiah Infokam*, *17*(1), 121–128.
Yamin, M. (2018). IT applications in healthcare management: a survey. *International Journal of Information Technology*, *10*(1), 503–509.
Zardecki, C., Dutta, S., Goodsell, D. S., Lowe, R., Voigt, M., & Burley, S. K. (2022). PDB-101: Educational resources supporting molecular explorations through biology and medicine. *Protein Science*, *31*(1), 129–140.