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Design of a Prototype of a Medical Check-Up Information System for ASN in Karawang Regency Using the Waterfall Method

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ABSTRACT

The State Civil Apparatus (ASN) is an important element in running the wheels of government. To maintain the performance and productivity of ASN, excellent health conditions are needed through periodic medical check-ups. This research aims to design and develop a web-based MCU information system prototype to automate and integrate the entire process. The study uses the waterfall method in software development, which includes five main stages: needs analysis, system design, prototype implementation, testing, and documentation. The effectiveness of this web-based medical check-up information system is generally at a very good level, with a percentage value of 96%. The highest observation aspect is the accuracy of data conveyed between units, at 100%, followed by an easy-to-understand web display at 98.6%. The research resulted in a prototype of the Medical Check Up information system, which includes online registration features, examination schedule management, filling and storing medical data, and reporting the results of ASN examinations. This system is designed to be responsive and easy to use by health workers and civil servants. Evaluation of the prototype showed that the system can speed up work processes, reduce recording errors, and provide centralized health data. The design of the prototype of the Medical Check Up information system has been proven to increase efficiency and accuracy in implementing MCU for ASN in Karawang Regency.

KEYWORDS *Information Systems, Medical Check Up, ASN, Waterfall, Karawang Regency*

INTRODUCTION

The eight Missions Asta Cita of the President's elected leadership in 2024-2029, which cover many aspects of national development contain the mission of human resource development (HR). This human resource development is aimed at creating a healthy, productive, and competitive Indonesian people at the world level1. This approach is focused on promotive and preventive efforts that are holistic, integrated, and people-centered. Medical Checkup is aimed at detecting health risk factors, pre-disease conditions, and diseases with the aim of improving the quality of life and life expectancy of the Indonesian people. This service is supported by innovation and the use of digital technology by the Electronic System Operator (PSE) both in the government and private sectors (Gunawan, Agushybana, & Kartasurya, 2020; Setyawati & Oktamianti, 2023).

In the adult and elderly groups, data showed that 33.6% of the population aged ≥20 years had low physical activity, 30.92% smoked, 23.4% were obese, and 30.8% of the population aged ≥18 years had hypertension. The prevalence of diabetes mellitus diagnosed by the doctor in the age group of 18-59 years reached 1.6%, while 10% had blood sugar levels above normal. This number is higher in the elderly group, using the prevalence of diabetes mellitus of 6.5% and abnormal blood sugar of 24.3% (Maulana, Azizah, & Eviyanti, 2023). For all age groups, the prevalence of cancer diagnosed by doctors is 1.2 per 1,000 people. Most of the risk factors,

pre-disease conditions, as well as these diseases can be prevented or treated early through regular health check-ups. however, the coverage of health checks in Indonesia is still low. Data from the Ministry of Health in 2023 shows that only 39.87% of the population has been screened for non-communicable diseases. In addition, 32.6% of the population aged >20 years have never checked their blood pressure, 80.82% have never measured their abdominal circumference, 35.61% have not monitored their weight, 61.6% have never checked their cholesterol levels, and 62.6% have never checked their blood sugar levels (Prasetya, Sintia, & Putri, 2022). Some of the six pillars of health transformation are primary service transformation, referral service transformation, health resilience system transformation, health financing system transformation, health human resource transformation and one of them is health technology transformation (Apriyani & Qodir, 2014; Effendy, 2013; Setiaji, 2025).

Data from the Central Statistics Agency in November 2021 explains that the number of labor force in Indonesia in 2020 amounted to 138.2 million people, of which 60.5% of the labor force worked in the informal sector and another 39.5% worked in the formal sector (Sari & Hamidy, 2021; Wijaya, Hendrastuty, & Ghufroni, 2022). This large workforce is certainly an asset that must be maintained in order to be able to work productively and have the ability to compete. Law No. 1 of 1970 concerning Occupational Safety has mandated the obligation for management/employers to carry out health checks for their employees, as also mentioned in Law No. 21 of 2003 on the discourse on the ratification of the ILO Convention and Law No. 11 of 2020 concerning Job Creation, which, among other things, regulates the discourse on employee health and safety. While in Law number 36 of 2009 concerning Health, in article 166 it is stated that employers or employers must ensure the health of workers through prevention, improvement, treatment and recovery efforts and must bear all costs of maintaining workers' health3. Regulations regarding the obligation of health checks for employees are also mentioned in Permenaker No. 2 of 1980 which states that to ensure the best physical ability and health of the workforce, it is necessary to hold targeted health checks both in terms of health checks before work, periodic health checks and specific health checks. This policy, in its implementation, of course, involves many parties, including hospitals, who are sick and health service providers (Kementerian Kesehatan RI, 2017; Marno & Sulistiadi, 2022).

BKPSDM data in 2024 shows that the total number of civil servants in Karawang is currently 12,332 (cumulative) consisting of 8,678 civil servants and 3,645 PPPK (Government Employees with Employment Agreements) with details of 3,897 male civil servants, 4,781 female civil servants, 1,358 male PPPK people and 2296 female PPPK people. Then there are several civil servants who die every year and there are 24 people in 2021, 12 people in 2022, 8 people in 2023, 7 people in 2024444. Apart from the above, every office or agency leader is required to organize office health and safety to create a healthy, fit, safe, performing, and productive office. It agency should be required to carry out periodic medical check-ups (MCU) every year (Nopriansyah, Wulandari, & Angastuti, 2024; Rahmawati & Aulawi, 2020). However, in its implementation, the participation in implementing the MCU for ASN is not optimal due to scheduling procedures that are still manual for recording and reporting so that it is ineffective, data is inaccurate, and information on MCU results is delayed. This has an impact on poor data quality so that information cannot be used for the decision-making process (Muyassaroh, 2018).

Therefore, a prototype of medical check-up information synthesis for ASN is expected to be able to answer health challenges and problems in Karawang district (*Medical Technology Development: An Introduction to the Innovation-Evaluation Nexus*, 2024). This aims to raise the awareness of civil servants on the importance of health, thereby encouraging more effective disease prevention and more targeted treatment. The prototype of medical check-up information synthesis for ASN is a new innovation to increase public awareness in conducting periodic health check-ups and expand the reach of health check-ups.

In this case, medical check-up health examination services are needed that are not only in accordance with the procedure, but also effective at the time of the implementation of the service. The series of examinations carried out at the medical check-up (MCU) installation service has the potential to prolong the waiting time for services or queues when a person receives MCU services, as well as the length of time to get the results of the examination. Fernandez, et all explained that the MCU service process has several challenges, including long waits. Another challenge is the length of time needed to receive MCU results, even it takes a relatively long time, which is approximately 3 to 7 days in the manufacturing process due to the MCU investigation because the manufacturing process due to the MCU examination still uses a manual method, which is only recording that the examination will occur in the medical record file but is not entered into the software system contained in the MCU. It is stated that the available MCU Information System is still limited to individual patient data only, while for the MCU service system information from physical examinations, supporting examinations and specialist doctor investigations, all of which still use a manual system. Thus, no MCU service data is input in the MCU5 service software.

Thus, as one of the manifestations of the application, the design of the MCU information system will make it easier and faster for users to collect data so that there is no longer a need to check data repeatedly. in processing, input and the creation of MCU reports becomes faster. The potential for errors in processing, input, and in making reports can also be reduced. The modeling of the MCU information system application will also form data that is spread using a non-standard format to be well organized, concise and support the expected information so that doctors can make decisions faster and more accurately6. From the employer/company side, of course, it will be very helpful to be able to see and compare what will happen in the MCU on a scheduled basis.

The design of the information system carried out to accelerate MCU services is innovative for Karawang Regency and is very relevant to the needs of ASN. By processing and analyzing data using information system design starting from patient registration to the results of MCU results, MCU results data can be presented appropriately, so that they can be integrated into one MCU results report that is good according to the needs of individuals and companies/agencies.

METHOD

The system design method used the Waterfall approach. The Waterfall model provides a sequential approach to the software lifecycle, from the analysis, design, coding, testing, and maintenance stages (Sugiyono, 2013).

The Waterfall method used in the design of the Medical Check-Up (MCU) information system had the following stages:

1. Data Collection: Data collection was carried out through literature studies, observations, and interviews with application users, especially ASN employees.
2. System Analysis: In this stage, an analysis of system requirements was conducted through interviews with application users to identify the needed data for creating the system. Interviews revealed that MCU in Karawang Regency still used manual methods for the administrative process.
3. System Design: Features and operations were described in detail using Unified Modeling Language (UML), including data analysis, database schema creation, and user interface design for the MCU information system. This stage involved flowcharts, use case diagrams, and class diagrams to illustrate the system's structure.
4. System Development: In this stage, the information system was built based on the existing design plan.
5. System Testing: After development, the application was tested using black-box testing to determine whether the MCU information system met user needs. Black-box testing is a software testing technique that focuses on functional specifications without examining internal details. It worked by entering data into each form¹⁰. This method revealed the system's functionality level, identified improper inputs, and ensured all features ran properly.
6. Implementation: To ensure the MCU information system was ready for use, users were trained on its flow and operations. This training also served as a trial to confirm that user needs were met. The system ran using the Google Chrome browser.
7. Launch and Promotion: Once the application was confirmed ready, it was officially launched. Promotional campaigns were conducted to increase awareness and attract users, promoted across social media including YouTube, Instagram, Facebook, Telegram, X (formerly Twitter), and others.

RESULT AND DISCUSSION

The results of the design of the medical checkup information system using the waterfall model, the researcher explained as follows:

Information System Design Analysis

a. List of Access Rights Groups

There are 8 groups of access rights that have been adjusted to the needs or tasks of each user.

1) Counter: Counter access rights can only open the patient menu. This menu functions to manage the patient's personal data.
2) Laboratory Admin: The access rights of the laboratory admin can only open the laboratory and laboratory check type menu. The check type menu functions to add the name of what test will be carried out and the laboratory menu functions to manage the results of laboratory tests.
3) Laboratory User: Laboratory user access rights can only open the Laboratory menu. This menu functions to manage the results of laboratory tests.

4) Radiology Admin: Radiology admin access rights can only open the radiology and radiology check type menu. The examination type menu functions to add the name of what examination will be performed and the laboratory menu functions to manage the results of radiological examinations.
5) Radiology User: The radiology user's access rights can only open the radiology menu. This menu functions to manage the results of radiological examinations.
6) Doctor: The doctor's access rights can only open the physical examination and conclusion menu. The physical examination menu functions to manage the results of the patient's physical examination and the conclusion menu functions to manage the conclusion of the patient's examination.
7) Admin Manager: The admin access right is the highest access where this access right can open the menu of all menus from registration to final check for maintenance of these menus
8) ASN User (patient): The right to access the results of the Medical Check Up via cellphone and agreement and emergency button.

b. Proposed System Flowchart

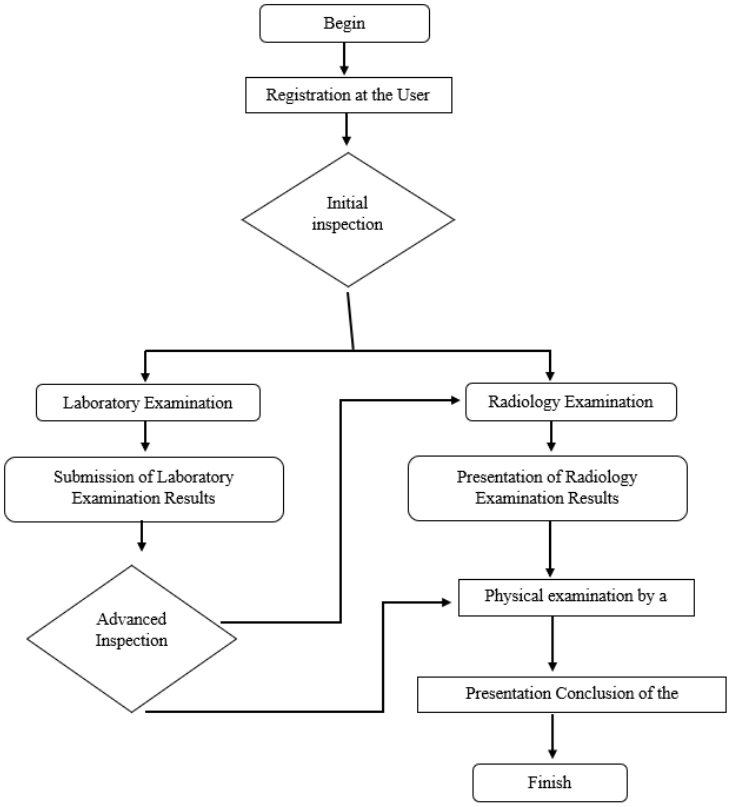

Figure 1. System Flowchart

Figure 1 is an overview of medical checkups. Starting from the beginning, the patient registers at the counter and then the patient chooses the initial examination; there are laboratory and radiological examinations. After the examination is carried out, the results of the examination will be submitted. If laboratory and radiology examinations are carried out both, they must go to the laboratory first and then to radiology. After that, it is included in a physical examination by the doctor and the submission of the conclusion of the examination.

c. Use Case Diagram

Use case diagram is a diagram that shows the relationship between an actor and a use case. Used for analysis and design of Database Design systems. Here are the use cases for designing a system

1) Use Case Login user dan admin

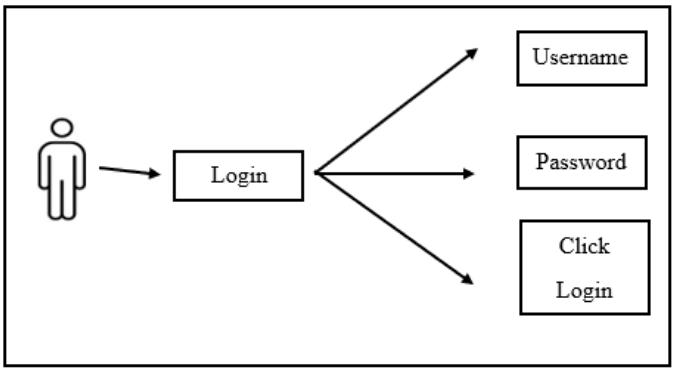

Figure 2. Use Case Login

The use case shows that each user has a different account. Then the system will redirect to the page that corresponds to the task of each user.

2) Use case manage patient data

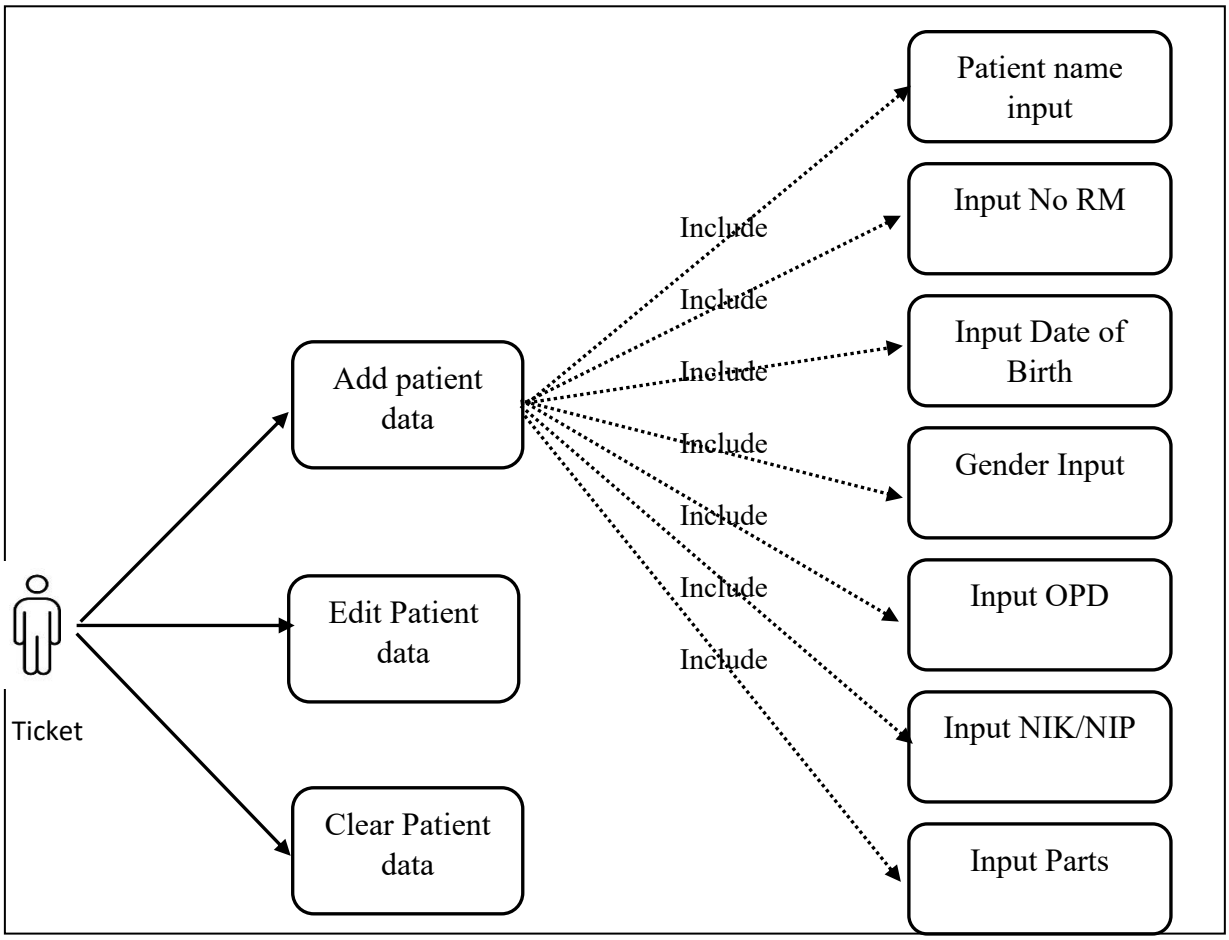

Figure 3. Use Case: Manage Patient Data

The use case shows that counter users can manage patient pages starting from adding, editing, and deleting patient data.

3) Use case manage laboratory examination type

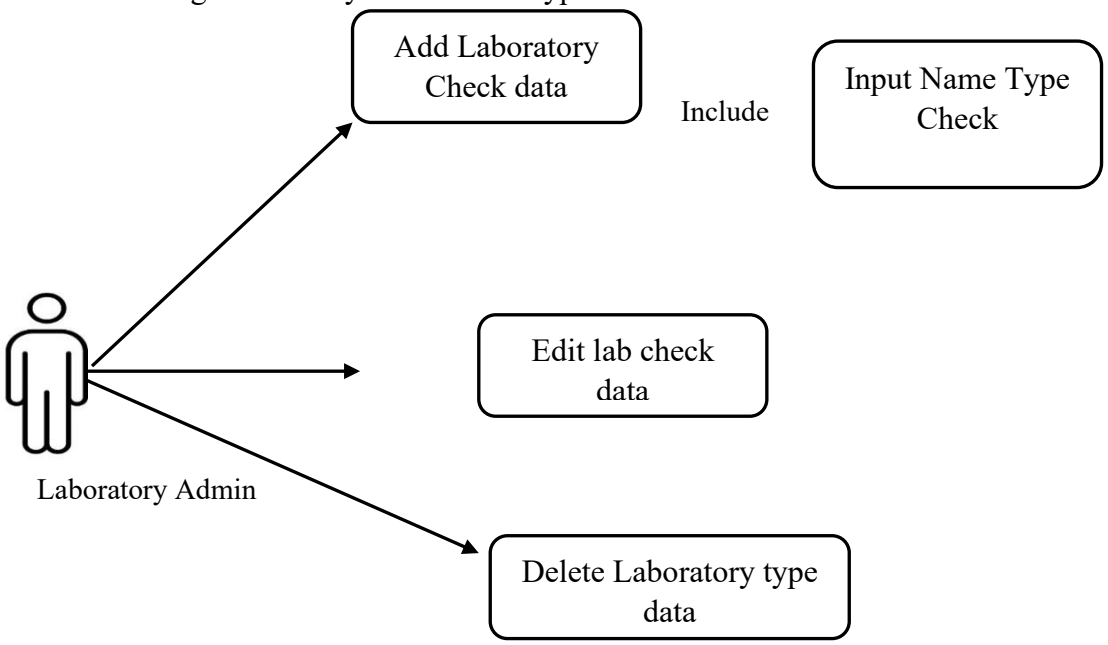

Figure 4. Use Cases Manage Laboratory Examination Types

Use cases show lab admins can manage check-type pages ranging from adding, editing, and removing.

4) Use case manage laboratory test results

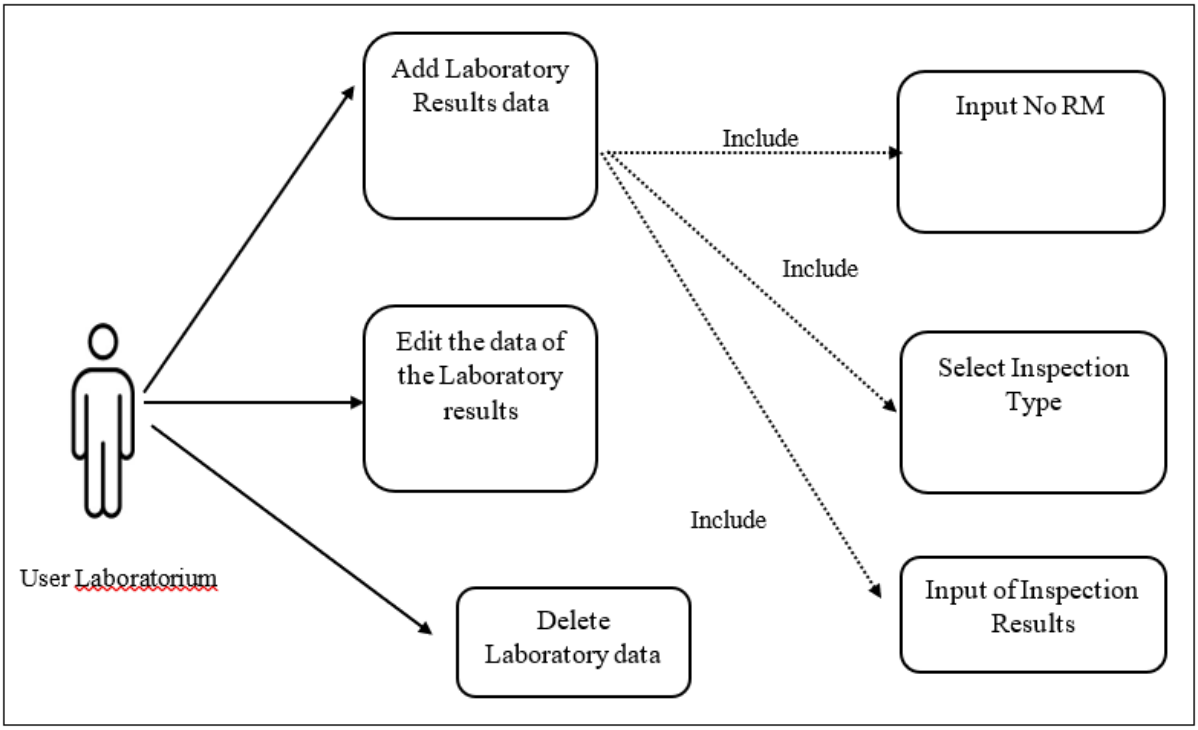

Figure 5. Use case manage laboratory test results

The use case shows that laboratory users can manage the pages of laboratory test results starting from adding, editing, and deleting.

5) Use case manage radiological examination type

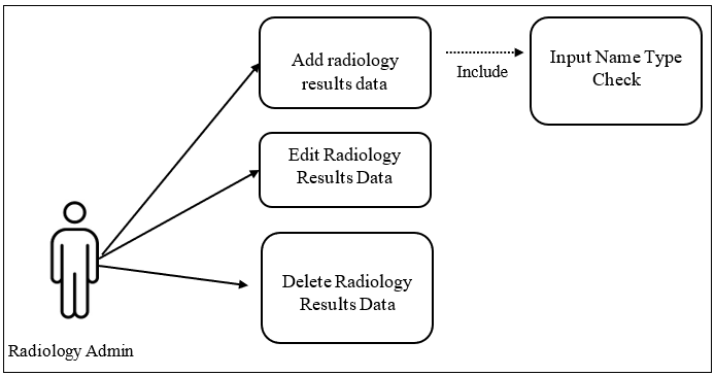

Figure 6. Use case manage radiological examination type

The use case shows that radiology admins can manage check-type pages from adding, editing, and removing.

6) Use case manage radiology examination results

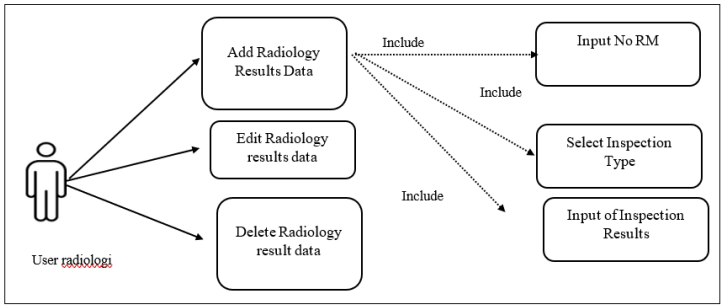

Figure 7. Use case manage radiology examination results

This use case shows that radiology users can manage the results of radiology examinations starting from adding, editing, and deleting data.

7) Use case manage physical examination results

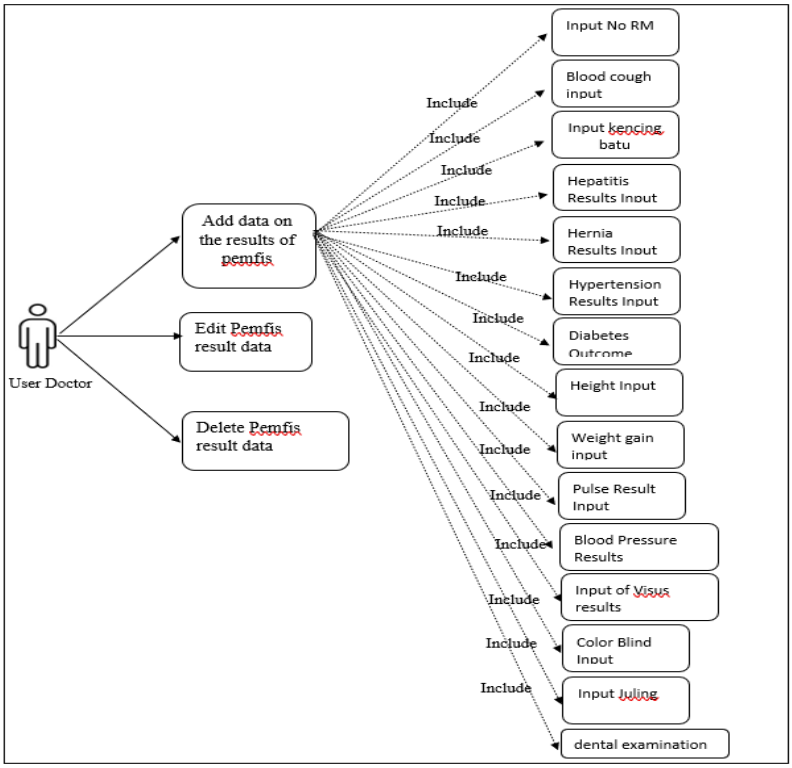

Figure 8. Use case manage physical examination results

The use case shows that the doctor user can manage the physical examination page from adding, editing, and deleting data.

8) Use case manage the results of the examination conclusion

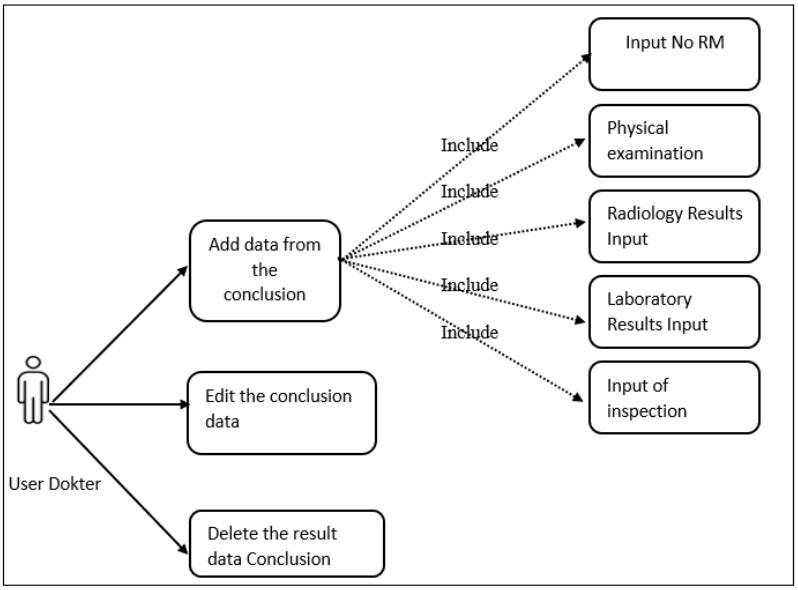

Figure 9. Use case manage the results of the examination conclusion

The use case shows that the doctor user can manage the examination conclusion page starting from adding, editing, and deleting data

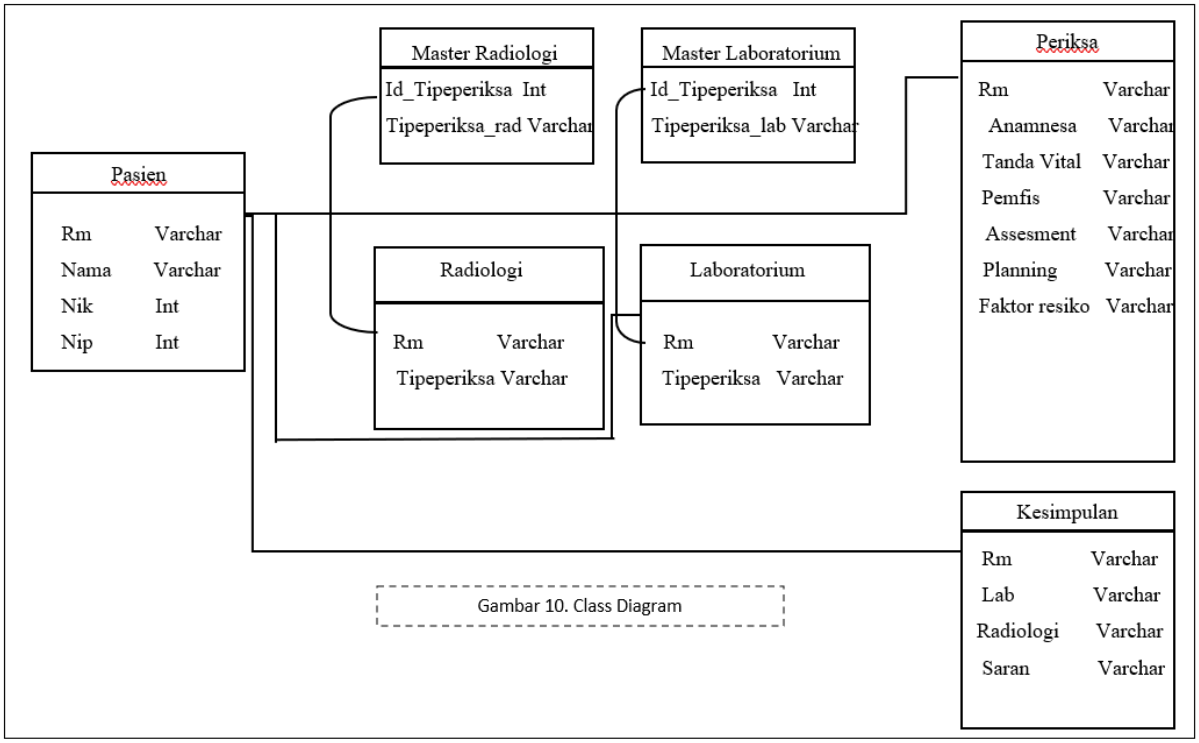

Figure 10. the doctor user can manage the examination

d. Class Diagram

A class diagram is a diagram that shows the relationships between classes in which there are attributes and functions of an object. From the program that has been created, it can be seen that the diagram classes are interconnected with each other. The class diagram can be seen in the image above.

Implementation Stage.

The application is implemented with source code to display an interface that was previously designed using a prototype application. The information system view is created with PHP markup format and the CodeIgniter 4 framework. The PHP format is aided by styling from Bootstrap to create a more user-friendly look.

a. Login Page: The login page serves to log in to the application according to their respective access rights.
b. Patient List Page: A list page of registered patients, equipped with several buttons.
c. Patient Data Form: The patient data fill form page to be registered, consisting of several fields, namely name, medical record number, company, NIK, NIP, age, and gender.
d. Laboratory Check Type List Page: A laboratory master menu that can only be accessed by laboratory users.
e. Lab Examination Results Fill Form: List of patients and laboratory test results.
f. Radiology Examination Results List: Radiology master menu.
g. Radiology Examination Results Filling Form: List of patients and results of radiology examination.
h. List of Anamnesia and Physical Examination Results Page: A form page for filling in the results of anamnesis and physical examination.
i. Physical Examination Results Fill Form: Physical examination results and pain scale form form.
j. Results of the Conclusion Result List: The list of patients who were given a conclusion using the SOAP method.
k. Conclusion Result Fill Form: The conclusion and assessment form is suitable to work or not from the examination results.
l. Medical Record Dashboard: A general view of medical records.
m. Medicheck ASN Portal: This portal is used to log in to the dashboard as a user.
n. Medicheck ASN Dashboard as a User: Dashboard view for ASN users.
o. ASN Profile Dashboard as User: Displays ASN user profile information.
p. Medical Lists and Secure Messaging Dashboard: This dashboard includes medical lists and secure messaging features.
q. Appointment Dashboard: Displays the appointment schedule.
r. Settings and Help Dashboard: Provides settings and help options.
s. Data Review Dashboard: A feature to review the data that has been entered.

System Testing

System testing serves to ensure that there are no errors in all features and to ensure the quality of the application that is made to match the expected design. Here are the results of the system testing:

Table 1. Blackbox testing from admin

Function Test	Process	Result
Form login	Input username & Password	Succeed
Patient Data Menu	Display Patient list	Succeed
Patient Data Input	The counter can input patient data	Succeed

Edit Patient Data	Counter can edit patient data	Succeed
Delete Patient Data	Counter can delete patient data	Succeed
Print Patient Data	The counter can print patient data	Succeed
Search Fields	The counter can search for the data needed	Succeed
Logout	Return to the Login page	Succeed

Table 2. Blackbox testing from doctors

Function Test	Process	Result
Form login	Input username & Password	Succeed
Check Menu	Displays a list of Examined Patients	Succeed
Input of Inspection Results	The doctor can input the Examination Results	Succeed
Delete Physical Examination Results	The doctor can delete the results of the examination	Succeed
View Physical Examination Results	The doctor may display a physical examination	Succeed
Conclusion Menu	Displays the data of patients who have been examined	Succeed
Input Conclusion	The doctor can input the results of the conclusion	Succeed
Edit Conclusion	The doctor can edit the conclusion	Succeed
Remove Conclusion Result	The doctor can remove the conclusion	Succeed
Print Conclusion	The doctor can print the results of the conclusion	Succeed
Search Fields	Doctors can search for the data needed	Succeed
Logout	Return to the login page	Succeed

Table 3. Testing from the Laboratory

Function Test	Process	Result
Form login	Input username & Password	Succeed
Laboratory Master Menu	View a Lab type checklist	Succeed
Laboratory check type inputs	The laboratory can input the type of Examination	Succeed
Laboratory Menu	Displays the data of patients who have been examined	Succeed
Laboratory test data input	Laboratory can input the results of the examination	Succeed
Edit lab test results	Labs can edit the test results	Succeed
Delete lab test results	Labs can delete the results of the examination	Succeed
Print lab test results	Laboratory can print the results of the examination	Succeed
Search fields	Labs can search for data	Succeed
Logout	Back to the Login Page	Succeed

Table 4. Balck box testing from Radiology

Function Test	Process	Result
Form login	Input username & Password	Succeed
Master Radiologists Menu	Displays Radiology type checklist	Succeed
Radiology type input	The laboratory can input the type of Examination	Succeed
Menu Radiologists	Displays the data of patients who have been examined	Succeed
Radiology examination data input	Radiology can input the results of the examination	Succeed

Function Test	Process	Result
Edit the results of the Radiology examination	Radiology can edit the results of the examination	Succeed
Remove the results of the Radiology examination	Radiology can remove the results of the examination	Succeed
Print the results of the Radiology examination	Radiology can print the results of the examination	Succeed
Search fields	Radiology can search for data	Succeed
Logout	Return to the login page	Succeed

User Testing

This test was carried out by involving 75 respondents to see the effectiveness of the application that had been made. Testing is carried out objectively, where testing is carried out on direct applications, by conducting a survey of employees or units that will specifically carry out the Medical Check Up process. The test results can be seen in Table 5.

Table 5. User Observation Results

Observation	Procedures carried out		Total Respondent	% Actual Score
	Yes	Not		
Are all menus and features in the application running properly	72	3	75	96%
Is the On-App View easy to understand	74	1	75	98,6%
Do you think the application is in accordance with the needs of the MCU process	70	5	75	93,3%
Compared to the previous MCU process which was still manual, this application helps speed up the examination process	71	4	75	94,6%
The Examination data sent such as the patient's name and results are accurate	75	0	75	100%
Are the MCU results fully informed	69	6	75	92%
Did everything go on time	65	10	75	86,6%

Based on the observations presented in Table 5, it can be concluded that the effectiveness of this web-based medical checkup information system is generally at a very good level, with a percentage value of 96%. The highest observation aspect is the accuracy of the data conveyed between units with a percentage of 100% and followed by an easy-to-understand web display with a percentage of 98.6%.

The aspect with the highest score in the observation was the accuracy of the data between units, which obtained a score of 100%. This indicates that this system is able to convey information on the results of medical check-ups accurately and accurately between related units, such as health services, personnel, and agency leaders (Singgih, 2024; Suryandari, Haryanto, & Roeswara, 2024). This good data integration is very important in the context of ASN services, considering that the accuracy of medical information is the basis for further

decision-making related to ASN development policies, medical referrals, and health monitoring (Rosmiati, 2023; Safaat, 2014).

The second highest aspect is the easy-to-understand web view, with a score of 98.6%. A simple, intuitive, and accessible user interface is one of the important factors that contribute to user acceptance of the system. This supports the principle of user-centered design which is a reference in the design of modern information systems.

However, there is still an aspect that needs attention, namely the timeliness of the system in operating, which obtained a score of 86.6%. Although it is in the good category, this value is the lowest compared to other aspects. This can be caused by several factors, such as limited network infrastructure, internet access speed, and system load when used simultaneously by multiple users. Therefore, improvements are needed on the performance optimization side, both in terms of server-side processing and client-side rendering, so that system response times can be faster and more efficient.

Overall, the results of this discussion strengthen that the prototype of the medical check-up information system for ASN Karawang Regency has met the main purpose of the research, which is to provide an integrated, accurate, and easy-to-use system. However, the results of the observations also provide a basis for further development, especially in terms of improving system performance so that it can run more optimally on a wider implementation scale.

CONCLUSION

This study concludes that the design and construction of a web-based Medical Check-Up (MCU) information system for Karawang Regency ASN using the Waterfall method successfully addressed existing challenges, with black-box testing confirming that all features operated effectively to enhance process efficiency, accelerate patient examination access, and improve health service quality. By automating manual processes like registration, scheduling, result recording, and data recapitulation through a simple, responsive interface, the prototype enabled systematic MCU management and rapid, accurate presentation of ASN health data—overcoming prior inefficiencies and errors. The system holds potential for full-scale development and implementation by local government agencies, supported by recommendations for regulations on MCU information systems, regional budget allocation, inter-OPD integration guidelines, and using ASN health data for policymaking, positioning Karawang Regency as a model for technology-driven personnel services and occupational health planning. For future research, integrating artificial intelligence for predictive health analytics or expanding the system to mobile platforms could further optimize preventive care and real-time monitoring for ASN.

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