# Development of LukaDia Wound Care:
## A Frontend Application for Efficient Diabetic Wound Monitoring Case Study at Klinik Pratama Muhammadiyah Kajen

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**Abstract**

*Diabetic wounds are serious complications often experienced by people with diabetes. Regular wound monitoring is crucial to prevent further complications. This study aims to design and develop an artificial intelligence-based healthcare information system called LukaDia Wound Care for monitoring diabetic wounds in diabetes care facilities. The research method used a waterfall software development approach. Development stages include needs analysis, system design, implementation, and testing. The results showed that LukaDia Wound Care was successfully developed with features that support the diabetic wound monitoring process, such as uploading wound images, measuring wound parameters, and generating wound progress reports. System testing at Klinik Pratama Muhammadiyah Kajen showed that the system is easy to use and beneficial for healthcare professionals in monitoring patients' diabetic wounds. The conclusion of this study indicates that LukaDia Wound Care has the potential to improve the quality of healthcare for people with diabetes.*

*Keywords: Diabetic Wound, Healthcare information system, artificial intelligence (AI), wound monitoring, frontend application*

## INTRODUCTION

Diabetic foot ulcers are a major complication of diabetes mellitus, significantly impacting patients' quality of life. Diabetes mellitus is a chronic disease characterized by elevated blood sugar levels. One of the serious complications of diabetes mellitus is chronic wounds, especially on the feet. These wounds are often difficult to heal and can lead to amputation if not managed properly. Regular wound monitoring is crucial to prevent further complications. (Chandu, 2013; Goss and Sambrook, 2013; Soegondo, 2013; Okonkwo and Dipietro, 2017; Maghfuri, 2020; MUH. ARDIN TIRO, 2020)

The management of diabetic wounds has traditionally been a labor-intensive process. Traditionally, diabetic wound monitoring has been done manually by healthcare professionals. This method has several drawbacks, including human error, inefficiency, and difficulty in tracking long-term wound progress. With the advancement of information technology, computer-based health information systems have been widely used to improve the quality of healthcare. One application of information technology that can be used in diabetic wound monitoring is an artificial intelligence-based health information system. (Nuraini, 2017; Febrianti, 2020; Safaruddin and Permatasari, 2022)

The management of diabetic wounds has traditionally been a labor-intensive process. An artificial intelligence-based health information system can assist healthcare professionals in monitoring diabetic wounds more effectively and efficiently. This system can be used to manage patient data, store wound images, analyze wound progression, and provide treatment recommendations. Consequently, this system can improve the quality of healthcare for

diabetes patients and reduce the risk of complications. (Nuraini, 2017; Febrianti, 2020)

Diabetic foot ulcers are a major complication of diabetes mellitus, significantly impacting patients' quality of life. The aim of this study is to design and develop an artificial intelligence-based healthcare information system called LukaDia Wound Care, which can be used to monitor diabetic wounds in diabetes care facilities. This system is expected to assist healthcare professionals in monitoring patients' wound progress more effectively and efficiently, thereby improving the quality of life of diabetes patients.

The LukaDia Wound Care system was evaluated in a real-world setting to assess its effectiveness in managing diabetic wounds. This case study was conducted at Klinik Pratama Muhammadiyah Kajen, involving diabetic patients with chronic wounds. Klinik Pratama Muhammadiyah Kajen was selected as the research site because it is one of the clinics with a significant number of diabetic patients. The results of this study demonstrated the potential of the LukaDia system to improve patient outcomes.

## LITERATURE REVIEW

### 2.1 Diabetes Mellitus dan Diabetic Wound

Diabetic foot ulcers are a major complication of diabetes mellitus, significantly impacting patients' quality of life. Diabetes mellitus is a chronic disease characterized by elevated blood sugar levels. Prolonged hyperglycemia can damage small blood vessels and nerves, leading to various complications, one of which is chronic wounds, especially on the feet. These wounds are difficult to heal and often require long-term care. (Chandu, 2013; Goss and Sambrook, 2013; Soegondo, 2013; Ansori, 2015; Bhatt, Saklani and Upadhayay, 2016; Okonkwo and Dipietro, 2017; Maghfuri, 2020; MUH. ARDIN TIRO, 2020; Alfaqih et al., 2021; Hakim, Ismunandar and Wahyuni, 2022).

### 2.2 Health Information System

Health Information Systems have become integral components of modern healthcare, facilitating efficient management of patient data, enhancing service delivery, and aiding in clinical decision-making. These systems, which can be paper-based, computerized, or web-based, enable swift and convenient access to patient information, thereby empowering healthcare providers to deliver optimal patient care. (Nuraini, 2017; Febrianti, 2020; Hakim, Ismunandar and Wahyuni, 2022; Santoso, Qona'ah and Erye Frety, 2022).

### 2.3 Artificial Intelligence in Healthcare

The integration of Artificial Intelligence (AI) into healthcare has the potential to transform patient care. Artificial Intelligence (AI) has shown great potential in various fields, including healthcare. The application of AI in healthcare can improve diagnostic accuracy, personalize treatment, and enhance healthcare service efficiency. One particularly exciting application of AI is in the field of medical imaging, where AI algorithms can analyze medical images, such as X-rays and MRIs, to detect diseases at earlier stages and with greater precision. (Wardani, Santoso and Asmara, 2014; Sabrina and Buditjahjanto, 2017; Supardianto, 2020; Niken et al., 2021; Emhandyksa, Soesanti and Susilowati, 2023)

### 2.4 Application of Artificial Intelligence in Wound Monitoring

The healthcare industry is rapidly evolving, and Artificial Intelligence (AI) is at the forefront of this transformation. The application of Artificial Intelligence in wound monitoring has become a focal point of research in recent years. Several studies have demonstrated that AI can be used to classify wound types, predict infection risk, and automatically monitor wound progression. By providing healthcare professionals with real-time insights, AI-powered wound care solutions have the potential to improve patient outcomes and reduce healthcare costs.(Herlina, 2019)

### 2.5 Research Gap

Research on the utilization of Expert System in diabetic wound monitoring has grown significantly in recent years. Several prior studies have explored the use of Expert System for wound type classification (Casal-Guisande et al., 2020; Farid Riyan Wijaya, Orisa and Primaswara Prasetya, 2023), infection risk prediction (Monteiro-Soares and Dinis-Ribeiro, 2016), and analysis of wound progression based on imaging (Poon and Friesen, 2015). For

instance, research by (Rostami *et al.*, 2021; Foltynski and Ladyzynski, 2023; Leizaola *et al.*, 2023) developed a deep learning-based diabetic wound segmentation algorithm to automatically measure wound area (Rostami *et al.*, 2021; Foltynski and Ladyzynski, 2023; Leizaola *et al.*, 2023). Meanwhile, (Anisuzzaman *et al.*, 2022; Dabas *et al.*, 2023) focused on developing an AI-based system to provide wound care recommendations based on clinical features and wound images.

However, the majority of previous research tends to focus on specific aspects of wound monitoring or the development of particular AI algorithms. Comprehensive research that integrates AI into a user-centric healthcare information system (HIS), particularly for the context of primary-level diabetes care homes such as Klinik Pratama Muhammadiyah Kajen, remains limited. The key difference in this research lies in the development of a frontend application specifically designed for healthcare professionals in primary clinics, considering existing clinical workflows and direct user needs. Furthermore, this study focuses on a case study of the system's implementation and usability evaluation directly within a real clinical setting, providing practical insights into the adoption and effectiveness of the system in the context of primary healthcare services in Indonesia.

In conclusion, the application of AI in wound monitoring holds great promise for improving patient outcomes. However, despite extensive research on the application of AI in wound monitoring, there are still several research gaps that need further exploration. One critical area for future research is the seamless integration of AI-based health information systems with existing electronic medical record systems. Additionally, studies investigating the factors influencing the acceptance of AI-based health information systems among healthcare professionals and patients are warranted.

## METHOD

### 3.1 Research Design

This research employs a waterfall software development approach to design and develop the LukaDia Wound Care health information system. The waterfall model was selected due to its sequential and easily understandable development stages. The stages of the waterfall model used in this research include: Needs Analysis, where data was collected through interviews with healthcare professionals and patients at the Muhammadiyah Kajen Primary Clinic to identify the needs and expectations of the system; System Design, where the system architecture, user interface design, and required database were designed; Implementation, where the system was developed using appropriate programming languages and tools; and Testing, where the system was tested to ensure it functions as expected. (Mahendra *et al.*, 2021; Fadillah and Ikasari, 2023).

### 3.2 Data Collection

The data used in this study was obtained through interviews conducted with healthcare professionals and patients at the Muhammadiyah Kajen Primary Clinic to explore information regarding the current process of diabetic wound monitoring, the challenges faced, and the need for a health information system; observation by directly observing the diabetic wound monitoring process at the clinic to understand the workflow and procedures performed; and literature review to obtain information about previously developed health information systems, especially those related to diabetic wound monitoring.

### 3.3 System Development

LukaDia Wound Care System was developed using HTML and CSS programming languages. The system consists of several main modules, namely the User Module for managing user data such as healthcare professionals and patients; the Patient Module for managing patient data, including medical history, wound data, and examination results; the Wound Module for managing wound data, such as wound size, depth, and exudate type; and the Report Module for generating patient wound progress reports in English.

### 3.4 System Testing

System testing was conducted to ensure that the system functions properly and meets user requirements. The testing conducted included unit testing, where each module was tested individually to ensure that each module functions correctly; integration testing, where the interaction between modules was tested to

ensure that all modules work together properly; and system testing, where the entire system was tested to ensure that the system performs as expected.

## RESULT AND DISCUSSION

The user interface of the LukaDia Wound Care system is designed with a focus on simplicity and ease of use. The main features that have been successfully implemented include a dashboard, a patient data input module, a wound data input module, and a report module.
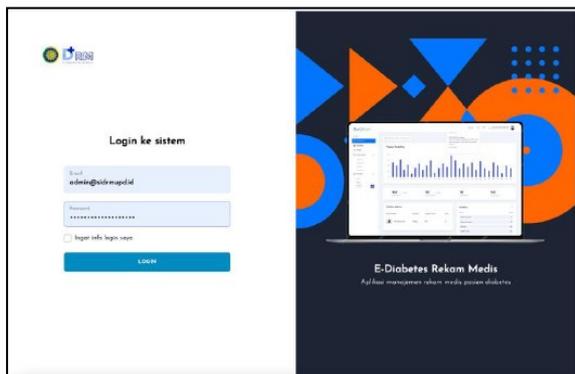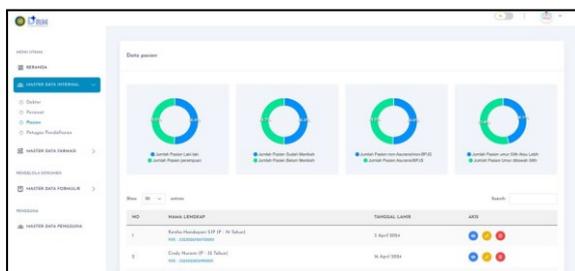


*Figure 1. Login Page*



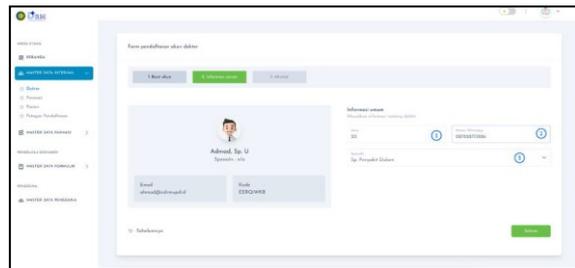*Figure 2. Home Page*



*Figure 3. Patient Page*



*Figure 4. Admin Page*

## CONCLUSION

The development of the LukaDia Wound Care system has demonstrated successful implementation of the features required for monitoring diabetic wounds, such as patient data input, wound data input, and report generation. The intuitively designed user interface facilitates the use of the system by healthcare professionals. Testing results indicate that the system has a fast and accurate response time in processing data. However, there are still some limitations, such as the absence of an automated notification feature to remind healthcare professionals of patient wound care schedules. Future development of the system will focus on integrating with electronic health records and incorporating advanced analytics capabilities

The results of this study align with previous research indicating that artificial intelligence-based health information systems can improve efficiency and effectiveness in wound monitoring. However, the LukaDia Wound Care system has an advantage in terms of integration with existing electronic medical record systems in clinics. The system's ability to integrate with existing infrastructure reduces the burden on healthcare providers and improves data quality.

For future development, it is recommended to add an automated notification feature, integration with wearable devices to monitor patient physiological parameters, and the development of machine learning algorithms to predict wound progression. By leveraging machine learning, the system can identify patterns in wound healing and predict potential complications

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