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Implementation of the Forward Chaining Method in a Web-Based Human Skin Disease Diagnosis Expert System

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Abstract: *Expert systems can be used as a tool to help diagnose early, including skin diseases, which often occur in tropical climates. Indonesia is one of the countries with a very high popularity of the spread of this skin disease. A technology-based media is needed to handle the problem of more public knowledge in diagnosing skin diseases early, quickly, and accurately. This study aims to implement forward chaining in an expert system for diagnosing skin diseases. The forward chaining method is used to carry out inference control. The Rapid Application Development (RAD) method is used as a methodology for developing an expert system, which consists of several stages, namely starting with the process of determining the objectives and scope of each aspect, making a prototype, collecting input from users, and testing and implementing the output produced. The results of this study are in the form of applications that the community can use to help diagnose early types of diseases and their treatments.*

Introduction

Indonesia is one of the countries with a very high popularity of the spread of this skin disease. Expert systems can be used as a tool to help diagnose early, including skin diseases, which often occur in tropical climates. Technology-based media is needed to address the need for more public knowledge in diagnosing skin diseases early, quickly, and accurately. An expert system is an artificial intelligence system designed to imitate the abilities and knowledge of a human expert in a particular field (Listiyono, 2008). The primary purpose of an expert system is to help users make complex decisions or solve problems requiring particular expertise (Putri, 2018).

Skin disease is one of the diseases that is influenced by the environment. One of the factors that causes many Indonesian people to suffer from skin disease is the tropical climate and environmental habits. Lack of public knowledge about the types of skin diseases is a need for technology in diagnosing a disease (Putri et al., 2019). Expert systems can be used as a solution to help the community because they have advantages in consultation efficiency so that people can find out the diagnosis quickly (Yanti & Desiani, 2023). *Expert systems* are a technology that can help diagnose skin diseases more quickly and accurately. In expert systems, the knowledge and experience of medical experts can be integrated into a system that can provide recommendations and diagnoses to users (Amalia et al., 2024).

Early detection and treatment of skin diseases are vital. While the current process requires someone to go to a hospital or a dermatologist, so they have to spend money and time to do early detection and treatment. The problem that often arises is that the

availability of specialist doctors or experts who know this skin field is limited. At the same time, many patients must have their diseases diagnosed immediately and treated immediately (Lubis et al., 2022). Medical personnel often have difficulty getting patients who complain of skin diseases into a clinic. This is because specialist doctors or experts are not present, while nurses can only serve patients optimally without the help of specialists.

Based on these problems, there is a need for an expert system that can diagnose skin diseases to make it easier for users to find skin diseases based on the symptoms experienced, prevention, and solutions provided in handling skin diseases as early as possible to avoid the onset of the disease becomes very necessary. Therefore, the author uses the Forward Chaining method to control inferences that contain the mechanism of thought patterns and reasoning used by experts in solving these problems. The Forward Chaining method is a method that starts from a set of data and then makes inferences according to the rules set until a conclusion is found (Wijaya, 2017). Based on the description above, this study focuses on implementing the Forward Chaining Method in a Web-Based Skin Disease Diagnosis Expert System.

Method

Data collection methods are a set of procedures or techniques used to collect information or data from the topic of investigation (Rahmadi, 2018). This study collected data by observing how doctors diagnose and treat patients with skin diseases and interviewing doctors at the Dr. Soenanto R, Sp. A clinic located at Jalan Utan Kayu Utara, Matraman, East Jakarta, and literature studies are needed to understand more about the symptoms of skin diseases—data Collection Methods by Observation, Interviews, and Literature Studies. In the observation, observations were made of the consultation process carried out by doctors with patients at the Dr. Soenanto R, Sp. A Clinic at Jalan Utan Kayu Utara, Matraman, East Jakarta, to obtain data on patient consultations with specialist doctors. In the interview, dermatologists at Dr. Soenanto R, Sp. were asked questions and answers. A Clinic to obtain information about skin diseases and how to deal with them by looking at the symptoms that appear in patients suffering from skin diseases. The literature study was related to the symptoms of existing skin diseases and web technology for the development of an Expert System. Literature study to collect references for making a diagnostic expert system program using the forward chaining method and information about literature reviews from books, journals, and papers.

Furthermore, this study uses a system development method. The method used in this study is Rapid Application Development (RAD) software development. RAD is an incremental software development process model in expert system development, especially for short processing times (Ajis et al., 2022). The research approach applied to this expert system research is decided as a framework for system development, using phases that describe the needs in designing a diagnostic expert system. The RAD method is one of the development methods in expert systems. This methodology prioritizes communication and cooperation with experts in detail as a guardian of the process until the software is assisted according to plan. The supporting method in conclusion is the forward chaining method.

Result and Discussion

Business Modeling

This system has two levels of users: an expert administrator and a general user. To access the system, the administrator needs to complete the login process. After logging in, the administrator can manage information related to disease symptoms to solve your skin problems. The administrator also has access to change and delete information, and vice versa; users can only register and diagnose disease symptoms to identify the skin health conditions they are experiencing.

Data Modeling

This expert system must be designed with specific medical needs and thoroughly tested to ensure that the diagnosis provided is reliable and meets applicable medical standards. Figure 1 shows the flowchart of the Expert System for Diagnosing Skin Diseases in Humans using Forward Chaining.

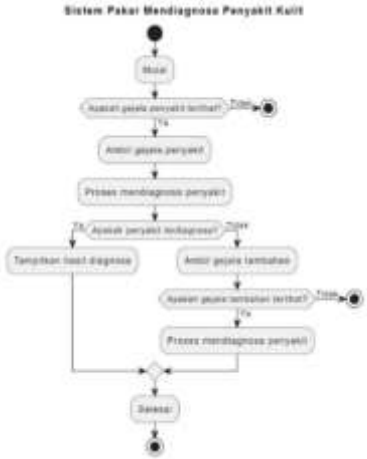

Figure 1. Flowchart of Expert System for Diagnosing Skin Diseases

Algorithm

The forward chaining method implements the inference process in an expert system. This algorithm works by starting from the symptoms or facts provided by the user and iteratively applying knowledge-based rules to reach a conclusion or diagnosis. This process is efficient because only rules relevant to the user's symptoms are evaluated. This expert system must be able to be updated regularly with the latest medical knowledge and new rules to improve diagnostic accuracy. Routine maintenance is also needed to ensure the system continues running optimally and meets user needs.

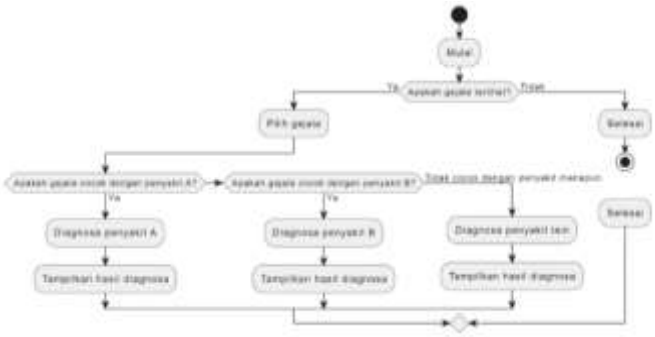

Figure 2. Expert System Algorithm for Diagnosing Skin Diseases

Discussion of the Algorithm The skin disease detection system has a knowledge base consisting of several facts and rules identified and used to generate the necessary

knowledge. This knowledge is obtained from the experience of several experts in the field of skin diseases. In order to apply this knowledge, the system follows existing principles and details them in an if-then format. By using these rules, the system forms knowledge by identifying the symptoms that appear and the types of diseases associated with them. The following is the knowledge data that has been collected.

Table 1. Skin Disease Data

Disease Code	Disease Name	Solution
P001	Eczema	Using Corticosteroid creams to reduce inflammation and itching
P002	Psoriasis	Using moisturizers and avoiding stress triggers
P003	Acne	Using gentle facial cleansers and topical acne medications
P004	Vitiligo	Using light therapy and depigmenting creams
P005	Rosacea	Using antibiotics and avoiding triggers such as alcohol
P006	Fungal Infection	Using topical or oral antifungal medications
P007	Herpes Zoster	Using antiviral medications and pain relievers

Table 2. Symptoms of Skin Diseases

Symptom Code	Symptom Code
G001	Dry Skin
G002	Itching
G003	Redness
G004	Blisters or Vesicles
G005	White Patches on Skin
G006	Skin Inflammation
G007	Scaling Skin
G008	Acne
G009	Acne-Prone Skin
G0010	Facial Swelling
G0011	Oily Skin
G0012	Hot Skin
G0013	Watering Sores
G0014	Skin Pain
G0015	Rash
G0016	Red Patches on Skin

Table 3. Relationships

Id_Relationships	Id_Symptom	Id_Diseases
1	1	1
2	2	1
3	3	1
4	5	1
5	6	2
6	7	2
7	16	2
8	8	3
9	9	3
10	11	3
11	5	4
12	3	5
13	10	5

14	12	5

1. Data Explanation
    a. Eczema (Disease with Disease_ID = 1):
    b. Related to symptoms of Id_symptoms 1, 2, 3, and 4.
2. Psoriasis (Disease with Disease_ID = 2):
    a. Related to symptoms of Id_symptoms 6, 7, and 16.
3. Acne (Disease with Disease_ID = 3):
    a. Related to symptoms of Id_symptoms 8, 9, and 11.
4. Vitiligo (Disease with Disease_ID = 4):
    a. Related to symptoms of Id_symptoms 5.
5. Rosacea (Disease with Disease_ID = 5):
    a. Related to symptoms of Id_symptoms 3, 10, and 12.

This table maps each symptom to its associated disease. With this relational table, it is easy to see which disease is associated with a particular symptom and vice versa.

Process Modeling

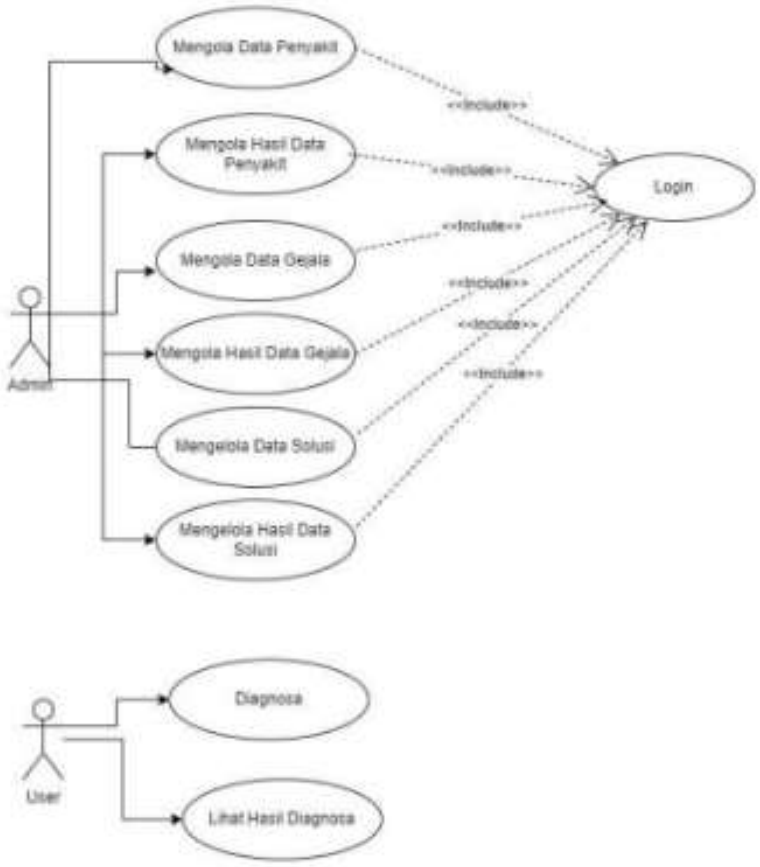

Figure 3. Usecase Diagram

Application Modeling

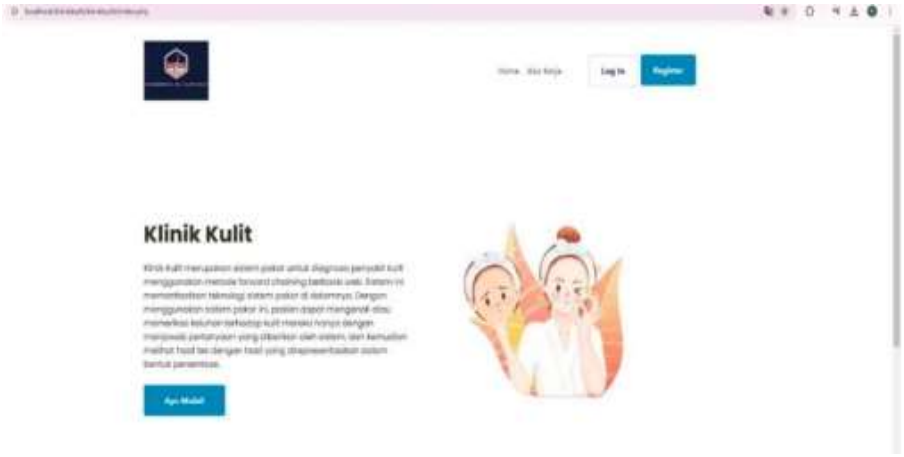

Figure 4. Screen Display

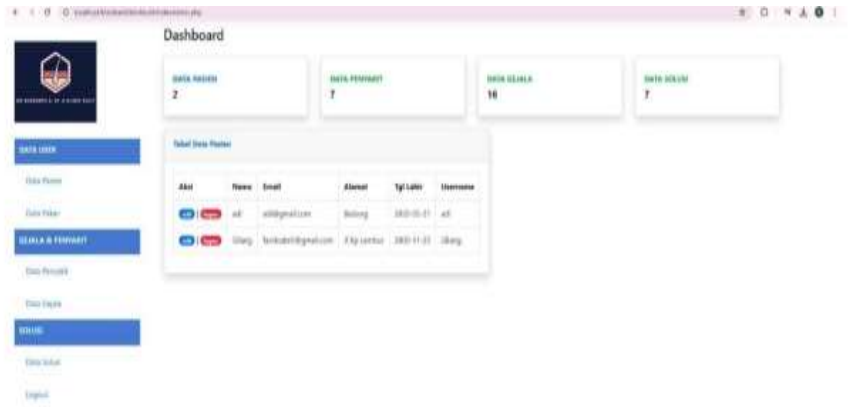

Figure 5. Patient Data View

Table 4. Black Box Test Results

Scenario	Parameters	Results
Opening the Home Page and Filling in Data	Successfully Filled in Data	Valid
Filling in Consultation	Successfully Filled in Questions about Symptoms Experienced	Valid
Receiving Diagnosis Results	Successfully Viewed Disease Diagnosis and Healing Solutions	Valid
Repeating Consultation	Successfully Repeated Consultation	Valid

Conclusion

This study has implemented the Forward Chaining Method on the Web-Based Human Skin Disease Diagnosis Expert System at the Dr. Soenanto R, Sp. A Clinic located at Jalan Utan Kayu Utara, Matraman, East Jakarta, successfully diagnoses and determines

human skin diseases based on the symptoms felt by the patient. This application can provide an effective solution in supporting more accurate and timely medical diagnosis for users.

Acknowledgements

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