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Website Based Respiratory Diseases Diagnosis Expert System Using Forward Chaining Method

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Abstract

This research aims to produce a website based expert system application that can diagnose respiratory diseases in humans. This research was conducted at the Tegal Parang sub-district health center using the forward chaining method. The forward chaining method is used to monitor the process of drawing conclusions in the expert system being built. The research stages carried out included an interview process with doctors and then analyzed using the forward chaining method. The forward chaining method was chosen because of its ability to provide accurate and easy to understand results by starting from existing facts and applying rules to reach conclusions. This method is very effective in expert systems for diagnosing respiratory diseases because it allows the process of drawing logical and systematic conclusions based on the initial data provided. This application was developed using HTML, PHP, JavaScript, CSS, and Bootstrap as programming languages, and MySQL for database management. The research results show that this application increases efficiency in data collection and reporting, makes it easier for medical personnel to manage patient data with a user-friendly interface, and manages diagnosis data in a computerized manner, thereby reducing human error and increasing efficiency. It is hoped that this research can make a significant contribution in simplifying the process of diagnosing respiratory diseases and improving the quality of health services at the Tegal Parang sub-district health center.

***Keywords**: Expert Systems, Diagnosis, Respiratory Diseases, Forward Chaining.*

1. INTRODUCTION

The respiratory system is very susceptible to diseases because air enters and exits directly and freely, air containing harmful bacteria and viruses easily enters the body, one of the causes of pain and death that often attacks is respiratory tract diseases (Fanny,et al., 2017). This system was created to be able to imitate the expertise of an expert in answering questions and solving a problem (Sibuea & Riyanto, 2020). With the application of the expert system, it is hoped that it can make it easier for users to

detect diseases/symptoms that occur so that they can carry out the treatment needed faster and more accurately (Hasanah,et al., 2017). From the background above, the author conducted research with title of website-based respiratory disease diagnosis expert system using the forward chaining method, so it can help provide practical solutions for patients.

Programming language used to write software that is designed to perform certain tasks on a computer or device mobile devices, As for the programming language used in application development is HTML, which is a standard programming language for creating web pages (Abdulghani & Gozali, 2019). Php is an open source scripting language that is widely used by web developers for web development (Siregar & Taufik, 2017). PHP is a code block designed to perform the function of receiving input in the form of parameters returning output used for web application development (Firman,et al., 2016). JavaScript is used to create drop-down menus and animations (IpanRipai, 2017). Bootstrap is a CSS framework that can build responsive WEBSITES easily and quickly (Dirgantara & Andrian, 2023). According to Jake Spurlock the advantages of using Bootstrap can adapt to WEBSITE needs (Satria,et al., 2022). CSS is used to create additional search functions and design face-to-face or user interfaces (Asry, 2022). CSS in modifying HTML so that the data can be implemented in the form of a WEBSITE (Rosyid & Permatasari, 2020).

Databases that are interconnected with each other to make decisions effectively and efficiently (Said, et al., 2023). XAMPP is needed as a localhost web server can manage databases without requiring internet access and (Fitriati & Gibran, 2021). A data-based management system software or Structured Query Language or SQL (Palit et al., 2015).

Relevant Research

Table.1 Relevant Research

No	Researcher (Year)	Research Title	Method	Research Result
1	Fanny, et al. (2017)	Design of an Expert System for Diagnosis of Tubular Acidosis Renalists Use the Certainty Factor Method With Forward Chaining Search	Certainty Factor	The expert system developed succeeded in increasing the accuracy of the diagnosis of Renal Tubular Acidosis using the Certainty Factor

				and Forward Chaining methods. This system is effective in identifying RTA symptoms with a high level of confidence, enabling early diagnosis and more appropriate treatment. The system is also easy to use, increasing users' understanding of the condition.
2	Isriyandi & Nurfalinda (2020)	Comparison Forward Method Chaining, Backward Chaining Dan Certainty Factor In System Expert Diagnose Disease Ingredients on Pregnant mother	Forward Chaining, Backward Chaining and Certainty Factor	Based on the results of 25 test data using the certainty factor method, the system accuracy level is more accurate compared to the forward chaining and backward chaining methods with a system accuracy value of 88%. the diagnosis result of the certainty factor method was 86.80%.
3	Hasanah, et al. (2017)	System Applications Detection Expert Damage Laptop/PC With Implementation Forward Method Chaining Use Language Programming PHP	Forward Chaining	System applications experts in particular applicationdetector damage laptop/PC, yes make it easierinner society repair damage to device their computer.
4	Sibuea & Riyanto (2020)	Expert system Diagnosis Troubleshooting Use Forward Method Chaining On Hardware Computer Android based	Forward Chaining	Research result show that application expert system diagnosis troubleshooting on the device computer deep solve problem when problems occur or damage on the device computer hard.
5	Fitri, Mega Orina (2021)	WebServer As an Alternative Xampp replacement On Platform Android	Qualitative	The research results show that the WebServer application has good quality in terms of functionality and usability.

Source : Private Document (2024)

2. METHOD

This research was carried out at the Tegal Parang Community Health Center, Jl. Mampang Prapatan XI No.28 7, RT.7/RW.4, Tegal Parang, Kec. Mampang Prpt., South Jakarta City, Special Capital Region of Jakarta 12790. This research was conducted for 4 months, starting from May 2024 to August 2024. This research began by identifying the problems that existed at the Tegal Parang Community Health Center and conducting a literature review. In this literature study the author looked at various sources, such as scientific journals, reference books, and articles. This is done to obtain information and find solutions to existing problems. Next, collect data through interviews with doctors. and the data obtained is explained in the form of identifying symptoms, causes and patterns of respiratory tract disease. After that, a problem-solving analysis was carried out which included the application of the forward chaining method to diagnose respiratory diseases. Next, apply the forward chaining method through steps in the form of determining symptoms and diseases, creating "if-then" rules, and determining the right diagnosis and solution to cure respiratory diseases using a Support Vector Machine (SVM) (Leleury & Tomasouw, 2015).

3. RESULTS AND DISCUSSION

In the process of developing the forward chaining algorithm it becomes a core component. This section will provide an in-depth analysis of the algorithm, including how it works, advantages, disadvantages, and its implementation within the framework of the expert system being built.

Figures and Tables

1. Determining Symptoms and Disease

Table 1. Disease Data

Kode Penyakit	Nama Penyakit
P001	Asma
P002	Bronkitis
P003	Pneumonia

P004	Empisema
P005	Paru Obstruktif Kronik
P006	Tuberkulosis
P007	Fibrosio Paru
P008	COVID-19
P009	Kanker Paru
P010	Emboli Pru

Source : Private Document (2024)

Table 2. Symptom Data

Kode Gejala	**Nama Gejala**
G001	Demam
G002	Batuk-batuk
G003	Hidung tersumbat/pilek
G004	Sakit kepala/Pusing
G005	Sakit tenggorokan
G006	Susah menelan
G007	Badan lemas dan lesu
G008	Sesak nafas
G009	Bersin – bersin
G010	Frekuensi nada cepat
G011	Suara Nafas kasar
G012	Nafsu makan berkurang
G013	Suara serak
G014	Gelisah
G015	Susah tidur
G016	Nyeri di dada
G017	Berkurangnya kemampuan indra penciuman
G018	Wajah terasa nyeri atau tertekan
G019	Bau mulut
G020	Sakit gigi
G021	Nyeri sendi atau nyeri otot
G022	Berkeringat dan menggigil
G023	Batuk dengan dahak kental berwarna atau disertai darah
G024	Diare
G025	Mual atau Muntah
G026	Nyeri bahu dan punggung
G027	Hidung berair
G028	Nyeri telinga
G029	Mata berair
G030	Dehidrasi

Source : Private Document (2024)

From the disease and symptom data, rules can be made to diagnose respiratory diseases in humans. Following are the rules:

a. IF G001 (fever) AND G002 (coughing) AND G003 (stuffy nose or runny nose) AND G007 (body weakness and lethargy) AND G008 (shortness of breath) AND G011 (rough breathing) AND G023 (cough with thick green phlegm , yellow or accompanied by blood) AND G027 (runny nose) THEN GP001 (bronchitis).
b. IF G001 (fever) AND G002 (coughing) AND G003 (stuffy nose or runny nose) AND G004 (headache or dizziness) AND G008 (shortness of breath) AND G009 (sneezing) AND G010 (rapid breathing frequency) AND G013 (hoarse voice) AND G015 (difficulty sleeping) AND G017 (decreased sense of smell) AND G018 (pain or pressure on the face) AND G019 (bad breath) AND (G020) toothache THEN GP002 (sinusitis).
c. IF G001 (fever) AND G002 (coughing) AND G007 (body weakness and lethargy) AND G008 (shortness of breath) AND G010 (rapid breathing frequency) AND G011 (rough breathing sounds) AND G012 (decreased appetite) AND G015 (insomnia) AND G030 (dehydration) THEN GP003 (bronchiolitis).
d. IF G001 (fever) AND G002 (coughing) AND G004 (headache or dizziness) AND G008 (shortness of breath) AND G010 (rapid breathing frequency) AND G012 (decreased appetite) AND G016 (chest pain) AND G023 (cough with thick phlegm colored green, yellow or with blood) AND G024 (diarrhea) THEN GP004 (pneumonia).
e. IF G001 (fever) AND G002 (coughing) AND G004 (headache or dizziness) AND G005 (sore throat) AND G006 (difficulty swallowing) AND G007 (body weakness and lethargy) AND G009 (sneezing) AND G012 (decreased appetite) AND G013 (hoarseness) AND G025 (nausea or vomiting) THEN GP005 (pharyngitis).
f. IF G001 (fever) AND G004 (headache/dizziness) AND G005 (sore throat) AND G006 (difficulty swallowing) AND G011 (rough breathing) AND G013 (hoarseness) AND G014 (anxiety) THEN GP006 (epiglottitis).
g. IF G001 (fever) AND G002 (coughing) AND G008 (shortness of breath) IF G010 (rapid breathing frequency) AND G016 (pain in the chest) AND G021 (joint pain or muscle pain) AND G022 (sweating and shivering) AND G023

(cough with thick green, yellow or blood-tinged phlegm) AND G026 (shoulder and back pain) THEN GP007 (pleuritis).

h. IF G001 (fever) AND G002 (coughing) AND G003 (stuffy nose or runny nose) AND G004 (headache or dizziness) AND G009 (sneezing) AND G013 (hoarseness) AND G017 (decreased sense of smell) AND G027 (runny nose) AND G029 (watery eyes) THEN GP008 (commond cold).

i. IF G001 (fever) AND G002 (coughing) AND G003 (stuffy nose or runny nose) AND G004 (headache or dizziness) AND G005 (sore throat) AND G006 (difficulty swallowing) AND G007 (body weakness and lethargy) AND G008 (shortness of breath) AND G009 (sneezing) AND G010 (rapid breathing frequency) AND G011 (rough breathing sounds) AND G012 (decreased appetite) AND G013 (hoarseness) AND G017 (reduced sense of smell) AND G022 (sweating and shivering) AND G029 (watery eyes) THEN GP009 ILI (Influenza Like Illness).

This decision table is used as a reference in creating decision trees and the rules used. The following is the decision table for diagnosing respiratory diseases:

Table.1 Decision Table

Kode Gejala	**Kode Penyakit**						
	GP001	**GP002**	**GP003**	**GP004**	**GP005**	**GP006**	**GP007**
G001	V	V	V	V	V	V	V
G002	V	V	V	V	V		V
G003	V	V					
G004		V		V	V	V	
G005					V	V	
G006					V	V	
G007	V		V		V		
G008	V	V	V	V			V
G009		V			V		
G010		V	V	V			V
G011	V		V			V	
G012			V	V	V		
G013		V			V	V	
G014						V	
G015		V	V				
G016				V			V
G017		V					
G018		V					

G019		V					
G020		V					
G021							V
G022							V
G023	V			V			V
G024				V			
G025				V	V		
G026							V
G027	V						
G028							
G029							
G030			V				

Source: Private Document (2024)

From the rules above, a decision tree for respiratory diseases in humans will be formed. A decision tree is a graph that describes objects which are then connected by labeled lines ("yes/Y" or "no/N"). This tree has a hierarchical structure consisting of nodes that store information.

We recommend that the substance of the article, if the author uses UML, then at least the diagram presented is a use case diagram, activity diagram or state diagram/sequence diagram of system behavior which is considered the main process in the author's research results and class/object diagram. If the author uses Data Flow Diagrams, then at least present context and zero diagrams and ERD. Apart from that, if the author also uses certain methods such as algorithms to solve problems, we recommend explaining the algorithm with pseudocode or algorithm flowcharts. It is hoped that the presentation of the user interface/UI will be sufficient for the important features in your research results.

1. Use Case Diagram

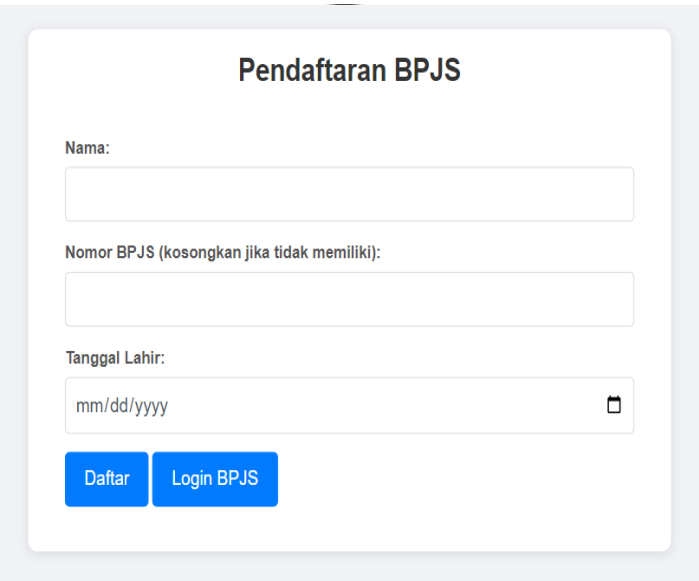
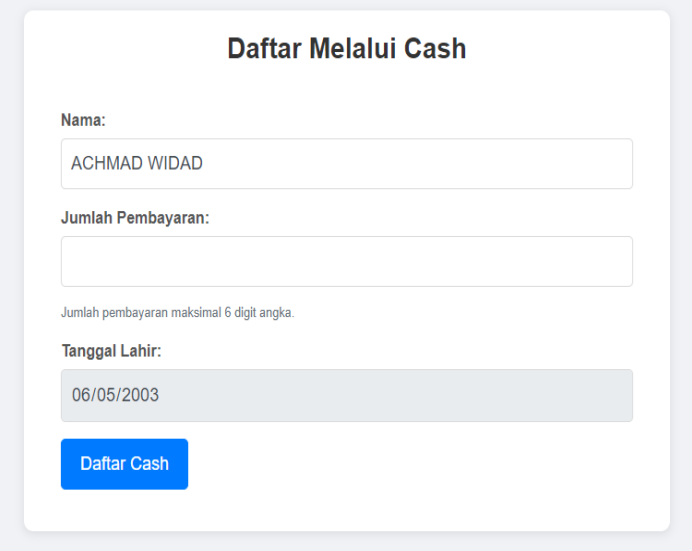


Figure 2. Use Case Diagram (Private Document, 2024)

Screen Display

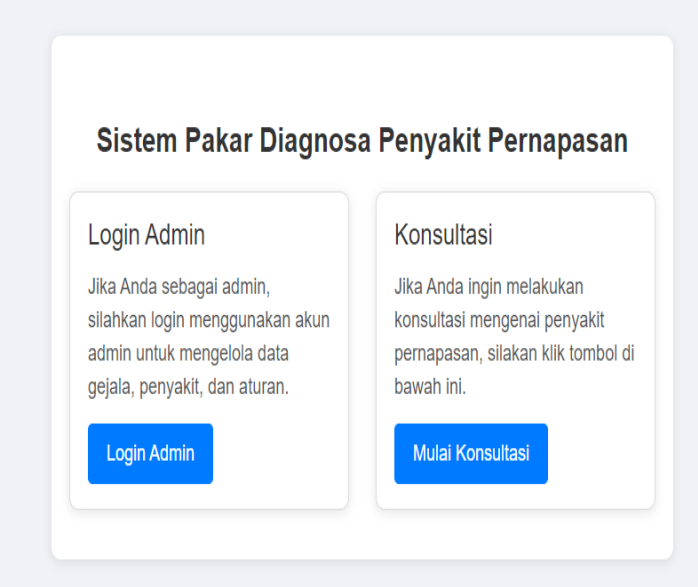
Figure 3. BPJS Registration Display (Private Document, 2024)

Here is the screen display of the Web-Based Expert System for Diagnosing



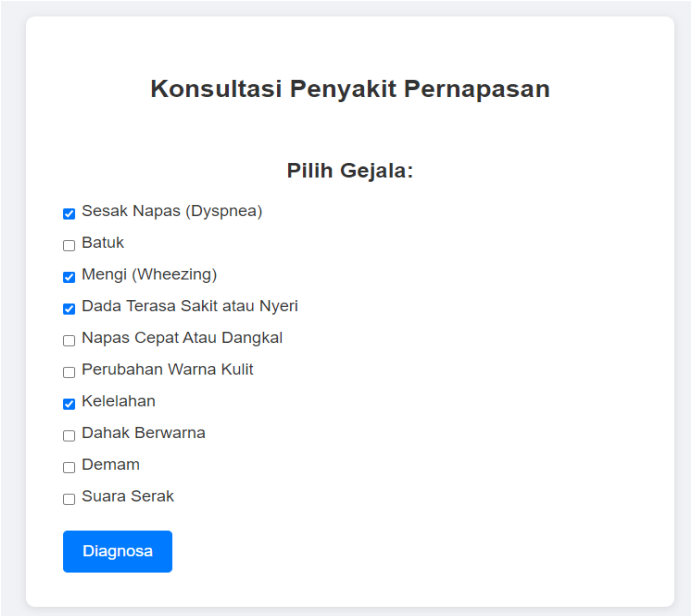
Respiratory Diseases Using the Forward Chaining Method: Users will enter their BPJS number if they are registered with the social security administration. If they are not registered, they will be directed to a cash registration form in the provided column.

Figure 4. Cash Registration Display (Private Document, 2024)



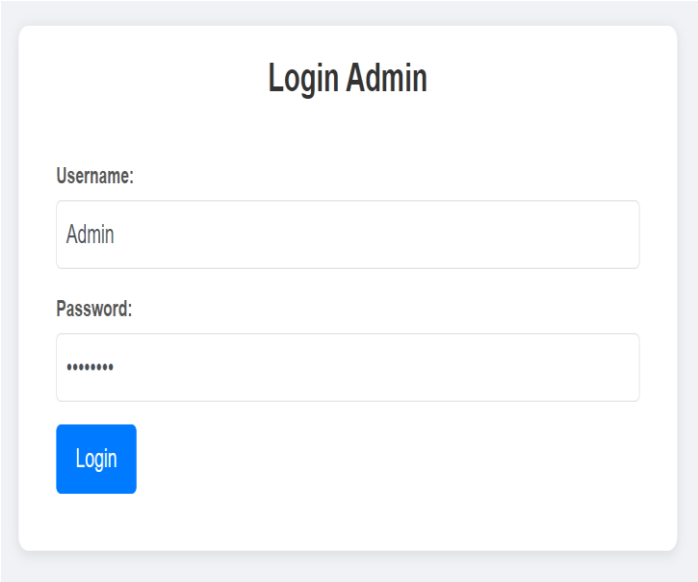
Users complete the registration through the provided form. Once all information is accurately filled in, they click the register button and receive a confirmation if the registration is successful, along with additional information or proof of registration.

Figure 5. User Index Page Display (Private Document, 2024)



Users who wish to consult about respiratory diseases can click on "Start Consultation" to be directed to a form or a series of questions that will help the system diagnose their condition based on the symptoms they are experiencing.

Figure 6. Consultation Form Display (Private Document, 2024)



Users can select the symptoms they are experiencing, such as shortness of breath, wheezing, chest pain, and fatigue, and can check the relevant symptoms. After selecting the appropriate symptoms, users can press the "Diagnose" button to receive a diagnosis result based on the provided input.

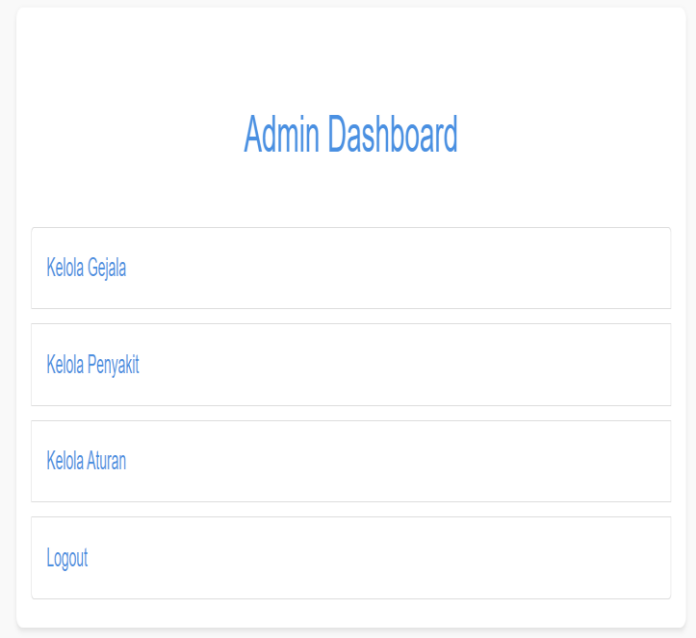


Figure 7. Admin Login Display (Private Document, 2024)

On the admin page, users are required to enter a username and password into the provided fields. This process ensures that only users with valid credentials can log in and manage the system.

Figure 8. Admin Dashboard Display (Private Document, 2024)

On the admin page, several options are provided to manage the system, including "Manage Symptoms," "Manage Diseases," and "Manage Rules." There is also a "Logout" option to exit the system. This dashboard allows the admin to easily access

and manage the necessary data.

Figure 9. BPJS Registration Print Display (Private Document, 2024)

The BPJS Registration Print Page displays when a user successfully completes registration using their BPJS card.

Figure 10. Diagnosis Result Display (Private Document, 2024)

The diagnosis result from the respiratory disease consultation lists several possible conditions, such as asthma, bronchitis, emphysema, and COVID-19. Each condition is accompanied by a brief description of its symptoms and causes. Users are also given options to either consult again or view a doctor's prescription based on the displayed diagnosis results.

Figure 11. Doctor's Prescription Result Display (Private Document, 2024)

The PDF print result for redeeming the prescribed medication.

4. CONCLUSION

This research successfully developed a web-based expert system for diagnosing respiratory diseases using the forward chaining method. The system effectively identifies common diseases such as influenza, bronchitis, and pneumonia, providing users with preliminary diagnostic results. The applied forward chaining method enables the system to diagnose diseases accurately based on the input symptoms,

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