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Expert System for Diagnosing Autism Spectrum Disorder (ASD) in Children Using the Forward Chaining Method (Case Study of the Bina Ananda Mandiri Foundation)

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ABSTRACT

Autism Spectrum Disorder (ASD), more commonly known as autism, is a neurological disorder that can affect a child's development. ASD is one of five types of disorders, including: Autistic Disorder (AD), Asperger Syndrome (AS), Childhood Disintegrative Disorder (CDD), Pervasive Developmental Disorder, and Rett Syndrome. At the Bina Ananda Mandiri Foundation, psychologists only visit once a year to diagnose ASD symptoms. With advancements in technology and various new innovations, the limitations of expert personnel and their knowledge can be addressed through technological progress. One step to address the shortage of experts is through the development of an expert system. The purpose of creating this expert system is to diagnose ASD and provide information and solutions to parents who have children with autism. The process in this expert system begins with data collection using the forward chaining method. The data is then processed according to established rules to generate conclusions as solutions to the problem. Developed using the PHP programming language, the ASD diagnosis expert system has been tested for accuracy using real-world case data with a value of 80%. The system effectively detects early signs of autism and presents the likelihood that a child may have autism.

Keyword : Autism Spectrum Disorder, Expert System, Forward Chaining, Psychologist

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1. INTRODUCTION

Autism Spectrum Disorder (ASD) is a complex neurodevelopmental disorder characterized by impaired social engagement and communication, restricted and repetitive patterns of behavior or interests, and changes in sensory processing. ASD is one of five types of disorders, including: Autistic Disorder (AD), Asperger Syndrome (AS), Childhood Disintegrative Disorder (CDD), Pervasive Developmental Disorder, Rett Syndrome.

With the development of technology and various new innovations, technological advances can overcome the limitations of experts and their knowledge. One solution to overcome the shortage of experts is to develop expert systems. Expert systems are computer systems that mimic the decision-making abilities of human experts. As mentioned, expert systems can support people in decision-making in many fields.

Expert systems are widely used in the medical field, including in psychology. The field known as cognition and psycholinguistics has emerged as a result of the combination of psychology and expert systems. Cognition and psycholinguistics are branches of psychology that study mental processes and language.

Applying the forward chaining method, which is one of several methods used in the field of artificial intelligence. This method requires the process to begin with data collection. The data is then processed according to applicable rules to generate conclusions as solutions to problems. This process is repeated until the correct result is obtained.

In the context of diagnosing ASD in children, this method is applied by collecting data on the symptoms that appear in the child, and then evaluating the data to determine whether the child has ASD

or not. With the ASD diagnosis expert system, an initial diagnosis can be made or initial recommendations can be given, which must be confirmed by a psychologist or other health professional.

The Bina Ananda Mandiri Foundation is an institution engaged in child welfare, including the development of competencies in children with special needs. Psychological tests for child diagnosis at the Bina Ananda Mandiri Foundation are only conducted once a year. The results of child diagnosis can help therapists in creating teaching programs and learning media. The use of media for learning greatly supports learning outcomes in children.

So, with this problem, we designed an expert system whose data source comes from the expert, Mrs. Dhiny Luna Wulandari, M.Psi, as a psychologist. With this system, we can make an initial diagnosis and also help in creating teaching programs.

2. RESEARCH METHOD

In evaluating a child's condition to determine whether or not they have autism, the approach used is the Forward Chaining method, which involves searching from the problem to drawing conclusions. When the premise clause matches the existing situation, the system will generate relevant conclusions. In other words, the Forward Chaining method helps us organize information based on symptoms and available data to assess whether a child may have autism or not.

3. RESULTS AND DISCUSSION

A. Implementation

This system is designed with a user-friendly interface so that users can better understand how to use the system. On the main page, there are three tabs that serve as menus for users. On each page, there is also a login form provided for experts or administrators to facilitate access when editing symptoms.

1. Consultation page: this page is used by users to select the type of symptoms they are experiencing. When users access the consultation page, they must first fill in the patient data before proceeding with the consultation. Once the patient data has been filled in, they can immediately select the symptoms they are experiencing.

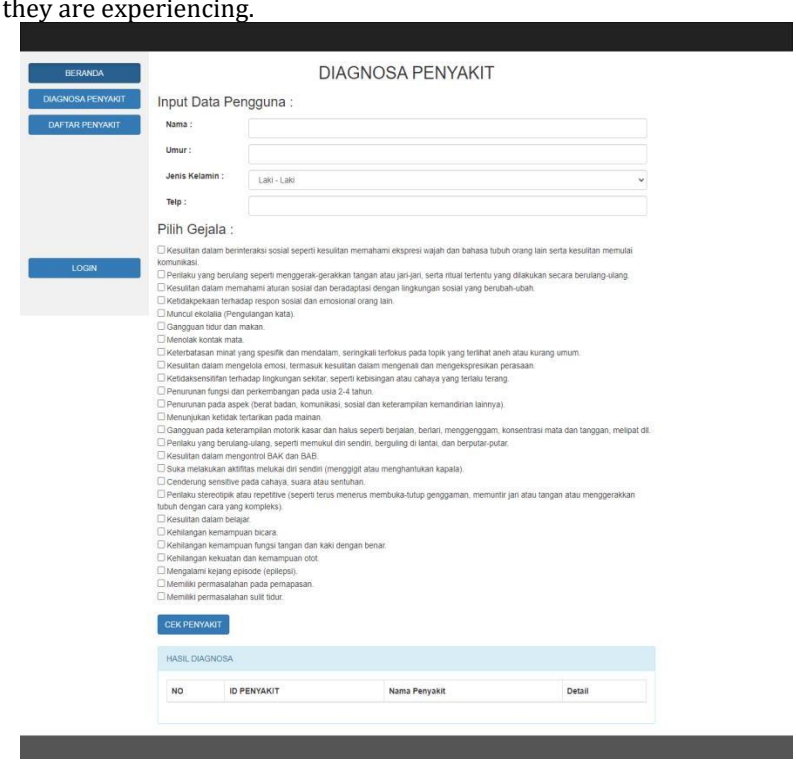

Figure 1. Disease Diagnosis Page

2. Diagnosis Details Page: This is a page displaying the results of the diagnosis performed by the user based on the selected symptoms, as shown in Figure 2. On this page, the user is not only given an

initial diagnosis, but also provided with an explanation or solution that can be implemented if the diagnosis results indicate one of the types of ASD.

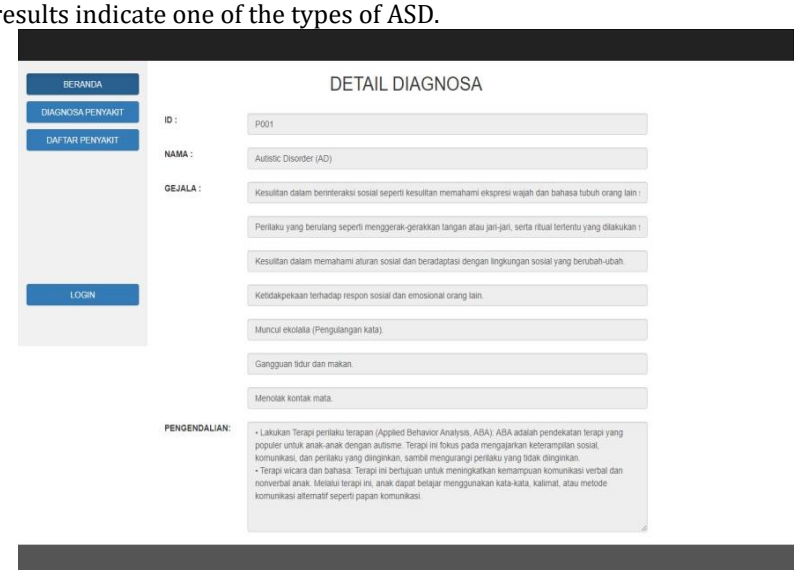

Figure 2. Diagnosis Details Page

3. Admin page: a page where you can input disease data, symptoms, and view user history. The admin page has 5 tabs, including: a disease menu for inputting disease data, a symptom menu for inputting symptom data, a decision menu for adjusting disease and symptom data, and a view history menu for viewing the history of users who have made diagnoses on the disease diagnosis page. The following is one of the admin pages in Figure 6, which is the disease list page.

Figure 3. Disease List Admin Page

B. Test Results

The test results for the system, which collected data from the Bina Ananda Mandiri Foundation, involved 25 children and can be viewed in the following view history menu:

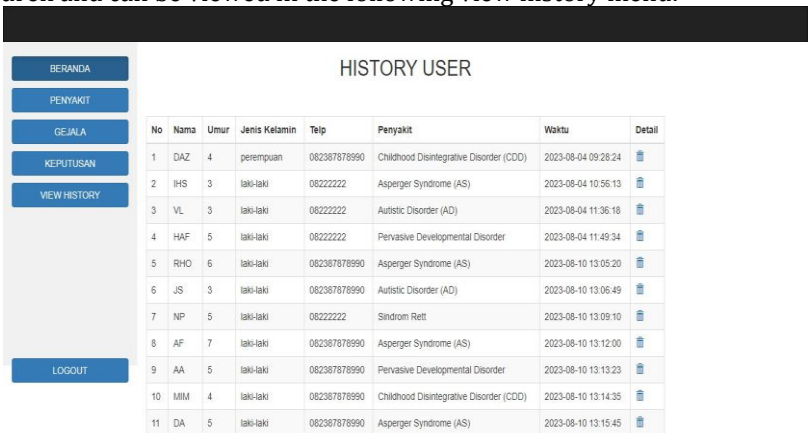

Figure 4. View History Page

The system testing data obtained from the Bina Ananda Mandiri Foundation can be seen in Table 1, which shows the results of testing the level of accuracy for users.

Table 1. Accuracy Testing

No	Name	Age	Patient Diagnosis	Expert System Diagnosis	Accuracy
1	DAZ	4	*Childhood Disintegrative Disorder*	*Childhood Disintegrative Disorder*	T
2	RH	10	*Autistic Disorder*	Tidak Terdeteksi	F
3	IHS	3	*Asperger Syndrome*	*Asperger Syndrome*	T
4	VL	3	*Autistic Disorder*	*Autistic Disorder*	T
5	HAF	5	*Pervasive Developmental Disorder*	*Pervasive Developmental Disorder*	T
6	RHO	6	*Asperger Syndrome* (AS)	*Asperger Syndrome* (AS)	T
7	JS	3	*Autistic Disorder* (AD)	*Autistic Disorder* (AD)	T
8	NP	5	*Sindrom Rett*	*Sindrom Rett*	T
9	AF	7	*Asperger Syndrome* (AS)	*Asperger Syndrome* (AS)	T
10	AA	5	*Pervasive Developmental Disorder*	*Pervasive Developmental Disorder*	T
11	AFA	5	Down syndrome & *Autistic Disorder* (AD)	Undetected	F
12	MIM	4	Childhood Disintegrative Disorder (CDD)	Childhood Disintegrative Disorder (CDD)	T
13	DA	5	Asperger Syndrome (AS)	Asperger Syndrome (AS)	T
14	H	4	Autistic Disorder (AD)	Undetected	F
15	SMH	6	Pervasive Developmental Disorder	Pervasive Developmental Disorder	T
16	HNH	5	Childhood Disintegrative Disorder (CDD)	Undetected	F
17	SSA	8	Sindrom Rett	Sindrom Rett	T
18	ADK	5	ADHD & Asperger Syndrome (AS)	Undetected	F
19	FK	4	Sindrom Rett	Sindrom Rett	T
20	G	3	Pervasive Developmental Disorder	Pervasive Developmental Disorder	T
21	FH	3	Asperger Syndrome	Asperger Syndrome	T
22	AD	4	Sindrom Rett	Sindrom Rett	T
23	EV	5	Childhood Disintegrative Disorder (CDD)	Childhood Disintegrative Disorder (CDD)	T
24	BD	5	Sindrom Rett	Sindrom Rett	T
25	C	2	Asperger Syndrome	Asperger Syndrome	T

Accuracy value Accuracy = $\sum match / \sum tp \; x100\%$
So the accuracy value = $20/25 \; x100\% = 80\%$

Therefore, it can be concluded that the accuracy level of the expert system, based on testing of 25 data points, reaches 80%, indicating that this expert system operates effectively and aligns with the assessments of expert specialists.

4. CONCLUSION

From the explanation discussed above, the following conclusions can be drawn: This system can serve as a tool to assist in diagnosing children who exhibit symptoms of ASD. The expert system is capable of providing solutions and offering information to individuals without specialized knowledge in identifying autism in children. Based on field testing using the expert system application, a success rate of approximately 80% was achieved, indicating that the application is sufficiently effective.

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