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Expert System for Identification of Diseases of Toddlers using Bayes' Theorem Method

Sandi Manalu
Teknik Informatika, STMIK Pelita Nusantara, Medan, Indonesia

A R T I C L E I N F O

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ABSTRACT (9 PT)

The disease is very susceptible to occur in children under five because the immune system in children under five has not been fully developed. Lack of knowledge about toddlers' illnesses as well as the symptoms experienced frighten parents. Information needs that are very fast from an expert to deal with problems or diseases of children under five expected by parents or the community. So that is what drives the development of a software application, namely the expert system for identification of children under five. An expert system for identification of toddlers is made as a tool to diagnose diseases experienced by children under five by using the symptoms experienced by children under five as a tool to detect diseases experienced by children under five. The system can identify 5 types of diseases with 23 symptoms of the disease. This expert system uses methods for developing problem identification, system design, implementation, and testing. Inference in this expert system uses the Bayes theorem method. This system is built with Visual Basic and Microsoft access as the database. The results of the consultation with this system indicate that the system is able to determine the disease and treatment solutions and the initial treatment that must be done, based on the symptoms previously chosen by the user.

Corresponding Author:

Sandi Manalu,
Program Studi Teknik Informatika,
STMIK Pelita Nusantara, Medan, Indonesia
Email: manalu.sandi@gmail.com

1. INTRODUCTION

Toddlers are very susceptible to disease, caused by the immune system in the toddler's body which is not yet fully developed and the lack of knowledge of the symptoms of a disease that makes parents afraid (Anggoro 2018) (Mahayu 2016) (Sutomo and yanti Anggraini 2010). Knowledge of the symptoms of a child's illness is very important because parents will be able to take early action so it doesn't reach a severe stage (Maddux et al. 2020) (Cheuk et al. 2004). The knowledge needed is information from a child health expert. The lack of knowledge of pediatric diseases to experts can result in delayed treatment. Problems that occur can be overcome by utilizing artificial intelligence technology. One of the artificial intelligence technologies is an expert system.

An expert system is a system that seeks to adopt human knowledge to a computer designed to model problem solving abilities like an expert (Wijaya 2020) (Khanna, Kaushik, and Barnela 2010) (Nansia and Sinaga 2020). In its preparation, the expert system combines inference rules with a certain knowledge base provided by one or more experts in a particular field. The combination of the two is stored in a computer, which is then used in the decision-making process for solving certain problems .

Bayes' theorem is a good method in machine learning based on training data, using conditional probability as a basis (Sugiarto n.d.). The Bayes method is also a method for generating parameter estimates by combining information from samples and other previously available information (Drummond and Rambaut 2007) (Bertorelle, Benazzo, and Mona 2010) (Hamada et al. 2004).

The Siabu Health Center is one of the health services for the community in the Mandailing Natal District. At the Siabu Health Center there are only three doctors consisting of one general practitioner and two dental specialists. The role of general practitioners at that time was very important because various kinds of diseases were handled not only for toddlers. To reduce the performance of general practitioners, the expert system would later act as a pediatrician and the supporting data would come from general practitioners. To deal with this problem, an expert system is needed. Performing a manual examination of the patient will take a long time. Doctors know the patient's illness but with this system can find out the cause of the illness and treat,

With an expert system, it is hoped that it can accelerate the identification of a disease in children under five so that they can find out the type of disease that is being experienced. To complete the expert system that is built, several methods can be used, but in using an expert system for identifying diseases in children under five, the author uses the Bayes theorem method

2. RESEARCH METHOD

In this study, researchers used an R&D (Research and Development) approach, the research method used was to collect data using the following techniques, namely;

a. Literature Study

   Literature study is one of the supporting elements as a theoretical basis for researchers to examine the problems discussed. In this case, the researcher uses several library sources including: Books, National Journals, and other sources.

b. Observation

   Observation is a data collection technique by conducting a direct review of the case study site where I will conduct the research at the Siabu Health Center. I observed patients who came to the health center and recorded some data on patients who had children under five and the symptoms experienced by these toddlers.

c. Interview

   Interviews were conducted by conducting questions and answers with related parties (aimed at doctors) to obtain information on diseases and symptoms in children under five that were needed in the software development process.

2.1 Data Analysis

System analysis aims to identify and evaluate the results of disease identification in children under five using Bayes' theorem method. identified in children under five.

3. RESULTS AND DISCUSSIONS

3.1 Application of Bayes' Theorem

Bayes theory is used to calculate the probability of an event occurring based on the effect obtained from the observations. Bayes theory is a rule that improves or revises a probability by utilizing additional information. That is, from the unfixed prior probability that is formulated based on

currently available information, then the next probability (posterior probability) is formed (Hartatik and Yasa 2015) (Dale 2012) (Xuan, Lu, and Zhang 2019).

Table 1. Table of data types of diseases of children under five

NO	Code Disease	Disease Name	Disease Solution
1	P01	ispa	Acetaminophen, Nebul Combivent 1 fls, Paracetamole drip and lapimox.
2	P02	Measles	Acetaminophen, Paracetamole, Cefadroxile and Vit A 200,000 IU.
3	P03	Ear infection	Acetaminophen, Forumen Ear Drops and Cefadroxil.
4	P04	Whooping cough	Erythromycin, Paracetamole, OBH and Cefradroxil.
5	P05	Chicken pox	Acyclovir Ointment, Paracetamole and Cefadroxil.

Table 2. Table of data types of diseases of children under five

Code Symptom	Symptoms Names	Mark Probability
G01	Frequent sneezing	0.1
G02	Stuffy and runny nose	0.4
G03	Lungs feel slow	0.6
G04	Cough cough and sore throat	0.4
G05	Often feel tired	0.1
G06	Body hurts	0.3
G07	Red eye	0.4
G08	Eyes sensitive to light	0.1
G09	Nasal congestion	0.6
G10	Fever	0.2
G11	Grayish white patches on mouth and throat	0.1
G12	High fever	0.8
G13	Hearing disorders	0.5
G14	Interesting ears	0.1
G15	Insomnia	0.6
G16	Runny nose	0.2
G17	Nasal congestion	0.2
G18	Red and watery eyes	0.4
G19	Cough	0.2
G20	Fever	0.4
G21	Stomach ache	0.2
G22	Sore throat	0.1
G23	Mild nausea	0.4

Table 3. Combination of Diseases with Symptoms

Symptom Code	Diseases of Toddlers				
	P01	P02	P03	P04	P05
G01	✓				
G02	✓				
G03	✓				
G04	✓				
G05	✓				
G06	✓				
G07		✓			
G08		✓			
G09		✓			

Symptom Code	Diseases of Toddlers				
	P01	P02	P03	P04	P05
G10		✓			
G11		✓			
G12			✓		
G13			✓		
G14			✓		
G15			✓		
G16				✓	
G17				✓	
G18				✓	
G19				✓	
G20					✓
G21					✓
G22					✓
G23					✓

Rulebase aims to regulate the relationship between disease and symptoms experienced by children under five. This rule will be used to determine the search process or determine the conclusions obtained. The rule is usually in the form of IF-THEN.
The rules in the knowledge base are as follows:

Rule 1:
IF the child has symptoms of G01 AND G02 AND G03 AND G04 AND G05 AND G06 THEN a child under five has P01, Acetaminophen Solution, Nebul Combivent 1 fls, Paracetamole drip and lapimox.
Rule 2:
IF the child has symptoms of G07 AND G08 AND G09 AND G010 AND G011 The child has disease P02, Solution of Acetaminophen, Paracetamole, Cefadroxile and Vit A 200,000 IU.
Rule 3:
IF the child has symptoms G012 AND G13 AND G14 AND G15 THEN Child has disease P03, Acetaminophen Solution, Forumen Ear Drops and Cefadroxil.
Rule 4:
If the child has symptoms of G16 AND G17 AND G18 AND G19, the child has P04 disease, Erythromicin Solution, Paracetamole, OBH and Cefradroxil.
Rule 5:
If the child has symptoms of G20 AND G21 AND G22 AND G23, the child has P05 disease, Solution for Acyclovir Ointment, Paracetamole and Cefadroxil.

3.2 System Implementation

System implementation is the stage in implementing the system that has been built, where later it will be known the quality of the system designed, whether it can run well and in accordance with the expected goals. In carrying out the implementation, several facilities related to hardware (hardware) and software (software) are prepared.

a. Main Menu Form

The main menu form is an interface between the user and the expert system application, on the main menu there are several menus that can be used by users, namely:

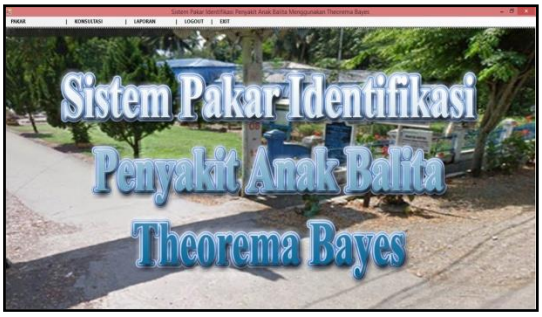

Figure 1. Main Menu Form

The Expert menu, which can only be used by admin users, while ordinary users cannot use the expert menu.

In the expert menu, there are sub menus, namely the Type of Disease Data Form, the Disease Symptoms Data Form and the Rules Database Form.

Consultation Menu, is a consultation menu that can be used by users and admins. On the consultation menu there is a sub menu, namely the Disease Diagnosis Form.

Report menu, is a menu that can be used by users and admins. On the report menu there is a sub menu, namely the Consultation Result Report.

Login, is a menu that can be used by admin users. At login there is a Login Form sub menu.

Exit, is a sub menu that can be used for customer and admin users which functions to close application programs.

b. Disease Type Form

Disease type form is a form used to manage disease type data such as adding disease type data, correcting disease type data and deleting disease type data. The picture of the form of the disease can be seen in Figure 2.

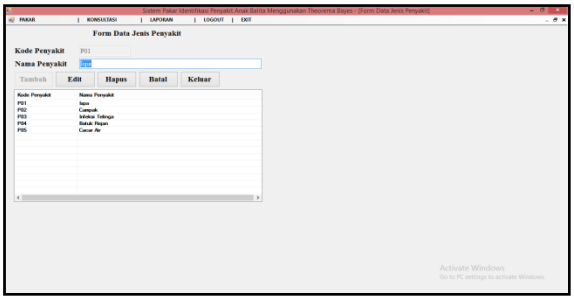

Figure 2. Disease Type Form Display

c. Disease Symptoms Form

Disease symptom form is a form used to manage disease symptom data such as adding disease symptom data, improving disease symptom data and deleting disease symptom data. The picture of the disease symptom form can be seen in Figure 3.

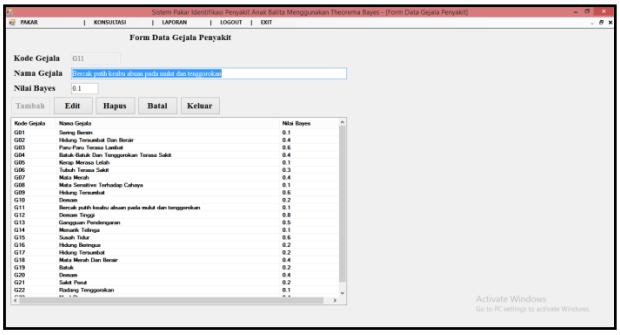

Figure 3. Disease Symptoms Form

d. Rule Base Form

The rule base form is a form that is used to manage rule base data such as adding rule base data, improving rule base data and deleting rule base data. The image of the rule form can be seen in Figure 4.

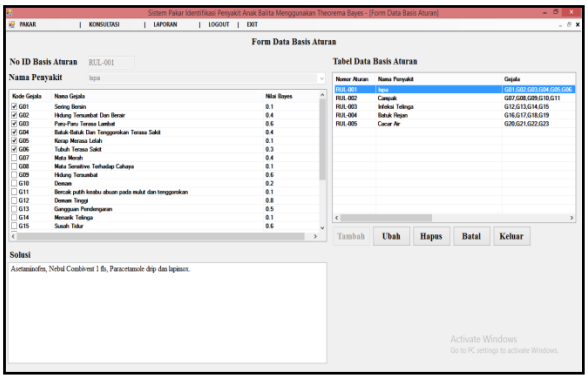

Figure 4. Rule Base Form

e. Consultation Form

Consultation form is a form used to manage consultation data such as adding consultation data, correcting consultation data and deleting consultation data. The picture of the consultation form can be seen in Figure 5.

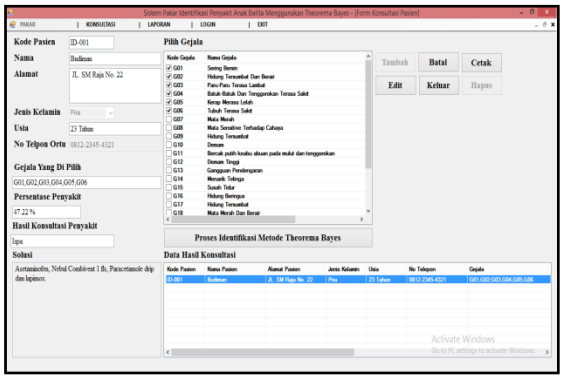

Figure 5. Consultation Form

f. Report Form

The report form is a form used to display data on the results of the diagnosis of toddler disease in the form of a report. The image of the report form can be seen in Figure 6.

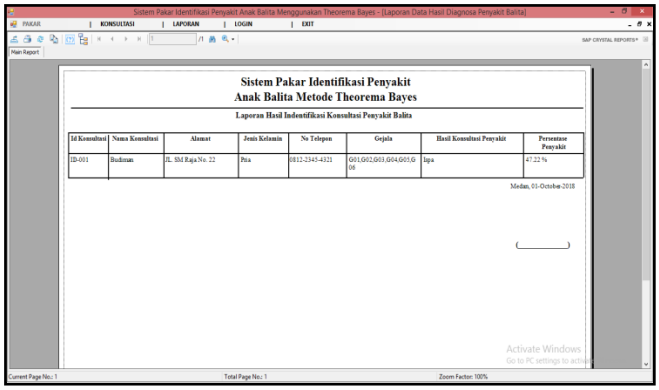

Figure 6. Report Form

3.1 Discussion

The results obtained from the existing discussion are the creation of an application system for identifying toddlers' diseases. In the implementation of this desktop program, we can make it easier for the public to know the types of diseases suffered by children under five by knowing the symptoms experienced by these children under five. In addition, the selection of the right application software, which has the ability to solve the problems that exist today. The software used in solving the existing problems are:

a. Microsoft Visual Basic Version 2010, Microsoft Visual Basic (often abbreviated as VB only) is a programming language that offers a visual Integrated Development Environment (IDE) for creating software programs based on the Microsoft Windows operating system using the programming model (COM). Visual Basic is a derivative of the BASIC programming language and offers rapid development of graphics-based computer software. Some scripting languages, such as Visual Basic for Applications (VBA) and Visual Basic Scripting Edition (VBScript), are similar to Visual Basic, but work differently. Programmers can build applications using the components provided by Microsoft Visual Basic. Programs written in Visual Basic can also use the Windows API,
b. Microsoft Access 2017, is a database application program that is used to design, create and manage databases easily and quickly. This is due to the ease of processing various types of databases and the final result is a report with a more attractive design. The database consists of: Tables, Forms, Reports.
c. Crystal Report Version 8.5, is one of the program packages used to create, analyze, and translate the information contained in the database into various types of reports. Crystal reports is designed to create reports that can be used with various Windows-based programming languages, such as Visual Basic, Visual C/C++, Visual Interdev, and Borland Delphi

4. CONCLUSION

Based on the results of data analysis in the previous chapters, it can be concluded that the expert system program to identify diseases of children under five was built using the Visual Basic 2010 programming language. children under five based on the symptoms experienced. By designing an expert system for identifying diseases of children under five, the community will be helped to find out the disease they are suffering from, so that people who experience ear disease can take early action to treat toddler diseases that are experienced. The Bayes theorem method can be a solution to the problem of identifying children's diseases.

REFERENCES

Anggoro, Eko. 2018. "GAMBARAN PERSEPSI ORANG TUA PADA KEJADIAN TB PARU ANAK DI POLI ANAK RUMAH SAKIT ISLAM KENDAL."

Bertorelle, Giorgio, Andrea Benazzo, and S Mona. 2010. "ABC as a Flexible Framework to Estimate Demography

over Space and Time: Some Cons, Many Pros." Molecular ecology 19(13): 2609–25.
Cheuk, D K L et al. 2004. "Parents' Understanding of Their Child's Congenital Heart Disease." Heart 90(4): 435–39.
Dale, Andrew I. 2012. A History of Inverse Probability: From Thomas Bayes to Karl Pearson. Springer Science & Business Media.
Drummond, Alexei J, and Andrew Rambaut. 2007. "BEAST: Bayesian Evolutionary Analysis by Sampling Trees." BMC evolutionary biology 7(1): 1–8.
Hamada, M et al. 2004. "A Fully Bayesian Approach for Combining Multilevel Failure Information in Fault Tree Quantification and Optimal Follow-on Resource Allocation." Reliability Engineering & System Safety 86(3): 297–305.
Hartatik, Hartatik, and I Ketut Putra Yasa. 2015. "Sistem Pakar Untuk Mendeteksi Hama Tanaman Jahe Menggunakan Teorema Bayes." Data Manajemen dan Teknologi Informasi (DASI) 16(2): 27.
Khanna, Satvika, Akhil Kaushik, and Manoj Barnela. 2010. "Expert Systems Advances in Education." In Proceedings of the National Conference on Computational Instrumentation NCCI-2010. CSIO, , 109–12.
Maddux, Michele et al. 2020. "Initial Validation of IBD KNOW-IT: Measuring Patient and Caregiver Knowledge of a Child's Disease and Treatment Regimen." Journal of clinical psychology in medical settings 27(3): 480–89.
Mahayu, Puri. 2016. Buku Lengkap Perawatan Bayi & Balita. Saufa.
Nansia, Oktavio, and Bosker Sinaga. 2020. "Expert System Diagnose Disease in Poultry Using Certainty Factor Method." Journal of Computer Networks, Architecture, and High-Performance Computing 2(1): 167–70.
Sugiarto, Widya. "PROSIDING SEMINAR NASIONAL MATEMATIKA DAN TERAPANNYA I (SEMNAS MANTAP I)."
Sutomo, Budi, and Dwi yanti Anggraini. 2010. Menu Sehat Alami Untuk Batita & Balita. DeMedia.
Wijaya, Lalu Kerta. 2020. "Web-Based Expert System To Detecte Chili Desease Using Rule Base Reasoning Approach." In Journal of Physics: Conference Series, IOP Publishing, 12026.
Xuan, Junyu, Jie Lu, and Guangquan Zhang. 2019. "A Survey on Bayesian Nonparametric Learning." ACM Computing Surveys (CSUR) 52(1): 1–36.