

Expert System for Diagnosing Children Allergic Diseases Through Web Forward Chaining

Adam Afriansyah, Ade Oktarino, and Arjon Turnip

Abstract— Expert system in the field of medicine that used to assist a doctor in analyzing and detecting a type of diseases based on felt symptoms of a patient is needed. This research has produced an expert system through web forward chaining to diagnose children allergic diseases and has been implemented at one of the public hospitals in Jambi. The web forward chaining method is also expected to help a parent to know the symptoms of allergic diseases in their children such that the quickly initial treatment methods could be made. This web application system was built using the PHP script language with MySQL database which is obtained and evaluated through literature studies, laboratory studies, and experiment. In the experiment test, the interpretation percentage of 89.2% was obtained.

Index Terms— Online Registration, Queue, Android, Hospital

I. INTRODUCTION

ALLERGIES are usually caused by food, animal hair, dust, drugs, and others. Most often attacked by allergies are children, because the body is in its infancy so it is more susceptible to disease. Common symptoms due to allergic reactions to a child's skin include itching, watery eyes, sneezing, runny nose, shortness of breath, abdominal pain, nausea, vomiting, feeling tired or sick, and hives.

Pediatricians at the Royal Prima Jambi General Hospital explained that allergic diseases in children that often occur include drug allergies, bronchial asthma, formula milk, food allergies, and allergic rhinitis. Some types of allergies in children are not dangerous, but some can cause the worst possibility especially late in handling. Quick early treatment at home can relieve these symptoms quickly. But unfortunately many parents who do not know how to prevent and treat allergies early.

To deal with these problems, an Expert System is needed. With an expert system, ordinary people will be able to solve problems or just simply look for quality information that can only be obtained with the help of experts in their fields. The expert system in the field of medicine helps a doctor to analyze certain diseases by knowing the patient's symptoms. In this study an expert system designed using the Forward chaining method was built. In the forward Chaining method

all data and rules will be traced to achieve the desired goals.

Forward chaining method is a search method or forward tracking technique that starts with existing information and combines rules to produce a conclusion or objective [1]. Forward trace inference methods are suitable for handling control and forecasting problems [2], [3]. Forward chaining technique is a technique that is often used for the inferencing process that starts the reasoning and a set of data to conclusions that can be drawn. Forward chaining technique is a method of reasoning that moves and IF part to THEN part. Various developments and implementations of the use of the method of forward chaining have been carried out [2-8].

An adjacent study by Supriyono, on an expert system for determining scholarship recipients. The results of testing the system have worked well seen from the fuzzy logic inference system can choose a prospective recipient like an expert [9]. While the application for disease detection has been done by Amarathunga, et al, namely using the J48 data mining method to detect the type of skin disease. The test results show the expert system is able to determine the type of skin disease without having to consult directly with the experts with the percentage of conformity of the system with the goal of 85%.

In this study an expert system through web forward chaining to diagnose allergic diseases in children at the Royal Prima General Hospital in Jambi has been built, tested, and implemented. In addition to facilitating the doctors, the system has also been used to help parents find out the symptoms of allergic diseases in children and how early treatment is needed to relieve these symptoms quickly.

II. METHODS

The research method is closely related to the procedures, techniques, tools, and research designs used. The research design must match the research approach chosen. Procedures, techniques, and tools used in research must also match the established research methods. In conducting this research, the author uses the "Qualitative Approach" which is an approach that integrates with the situation and phenomenon under study, using the researcher as an instrument. The design is general in nature, to find theories, describe complex realities, and to gain an understanding of meaning by using data collection techniques of observation, interviews, and documentation with researchers as instruments.

The research work to be used is as follows: Literature study, data collection, system analysis, development, and reporting. Literature study is conducted to identify the problems that

Manuscript received September 9, 2019. This work was supported by Indonesian Institute of Sciences and Universitas Adiwangsa Jambi, Indonesia.

Ade Oktoarino and Adam Afriansyah is with the Faculty of Engineering and Computer Science, Jambi, Indonesia (e-mail: jambei57@gmail.com).

Arjon Turnip is with the Department of Electrical Engineering, Universitas Padjadjaran Indonesia (corresponding author, e-mail: jujhin@gmail.com).

occur in the field. Then do a search of various books, journals, and the internet related to the problem in finding the theoretical basis as well as support and comparison. Data collection was carried out by means of observation, interviews at the Royal Prima Hospital Jambi. Observations by the method of observation carried out by direct observation of the object to be studied aims to strengthen the data and know firsthand how the process of detecting allergic diseases in children and appropriate treatment at Royal Prima Hospital. Interviews were conducted by understanding the problems that occur in the process of detecting allergic diseases in children and appropriate treatment. Interviews were conducted with Pediatricians, as well as staff and nurses on duty at Royal Prima Hospital. Document analysis is a complement to the use of observation and interview methods in qualitative research.

In the system analysis phase aims to analyze the existing problems, in the form of problems that occur in the process of detecting allergic diseases in children that occur before. In development, the waterfall model or what can be called also the classic life cycle is used. The advantage of the waterfall model is that it reflects the practicality of engineering that keeps software quality intact because of its structured and supervised development. Furthermore, the preparation of reports is based on the results of research using primary data collection techniques or secondary data and uses research methods that are relevant and directed to the subject matter that exists.

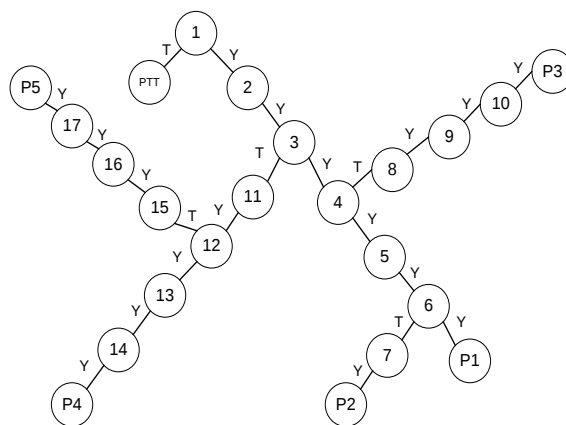
Through the stages and research framework above, several system requirements are obtained as follows: Input requirements in the form, patient data, types of allergic diseases in children, questions related to allergic disease symptoms experienced by children, rule questions, and checking for allergic diseases in child. Process needs include: login process for administrators, data processing: admin, patients, types of allergies in children, questions, rules, checking and results. The resulting output requirement is checking for allergic diseases in children. Software requirements needed include: Windows 7 Operating System, Web Server Engine: WampServer, Browser: Google Chrome, Database server: SQL Yog (MySQL), Text Editor: Adobe Dreamweaver CS5, and other supporting software. While the hardware requirements are the Intel Core i3 2.0 GHz Laptop Processor, 2GB DDR3 RAM, 500GB Hard Drive, and Printer.

Types of allergic diseases that are often experienced by children: P1 is Milk Formula Allergy Disease, P2 is Food Allergy Disease, P3 is Drug Allergy Disease, P4 is Bronchial Asthma Disease, P5 is Allergic Rhinitis, PTT, that is Undetected Disease. The list of questions needed in data collection can be seen as in Table 1.

The tree picture of the inference channel for allergic diseases in children is depicted in the form of a forward chaining decision tree as shown in Fig. 1. Starting with the description of disease characteristics to produce a goal in the form of one type of allergic disease in children. The results of the disease are obtained from the application user's answers to the relating questions of the disease characteristics raised by the application.

No.	List of questions that include symptoms of allergic disease which is often experienced by children
1	Does your child have a runny nose, stuffy nose, or repeatedly cough?
2	Does Your Child Have Shortness of Breath Or Asthma Until Lung Disorders?
3	Does Your Child Have Shortness of Breath Or Asthma Until Lung Disorders?
4	Does your child experience redness or bumps on the skin or other body parts?
5	Does Your Child Have Stomach Pain That Is Twisted Or Even Diarrhea?
6	Does Your Child's Stool Contain Blood When Defecating?
7	Is Your Child Vomiting?
8	Does your child's face turn pale or experience fainting due to a drastic drop in blood pressure?
No.	List of questions that include symptoms of allergic diseases that are often experienced by children
9	Has your child's skin become flaky?
10	Does Your Child Have Blood / Kidney / Liver Disorders?
11	Are the Symptoms Increasingly Overnight at Night Causing Sleep Difficulties?
12	Does Your Child Feel His Chest Like Depression and Phlegm?
13	Are the Symptoms Can Be Improved Spontaneously Because Giving Asthma Relief Medications But Are Temporary?
14	Are the Symptoms Arising from the Originator, such as Cigarette Smoke, Mosquito Coils Smoke, Cold Foods / Drinks, etc.?
15	Does your child have itching on the nose and eyes?
16	Does Your Child Have Smell Disorders Until Sinusitis?
17	Is Your Child's Eyes Under Dark and Mouth Always Open?

The steps that must be taken in creating a rules-based forward chaining system are: Defining the problem (including problem domain selection and knowledge acquisition); defining data input forward chaining systems require initial data to start inference; defining data control structure; initial code writing namely to determine whether the system has captured the domain of knowledge effectively in a good rule structure; System testing is done with several rules to test the extent to which the system runs correctly; Interface design is done together with the creation of a knowledge base; System development which includes adding interfaces and knowledge according to the system prototype; System evaluation in the form of testing the system with the real problem. If the system does not work well, redevelopment will be carried out.



III. RESULTS AND DISCUSSIONS

It is known that allergic diseases in children that often occur include allergic milk formula, drug allergies, bronchial asthma, food allergies, and allergic rhinitis. Some types of allergies in children are not dangerous, but some can cause the worst possibility especially late in handling. Even though a quick start at home can relieve these symptoms quickly. But unfortunately many parents who do not know how to prevent and treat allergies early. Expert system through web forward chaining to diagnose allergic diseases in children was built using the PHP script language and MySQL Database. The expert system that was built has the ability to: Help make it easier for parents to know the symptoms of allergic diseases in children and the initial treatment methods needed to relieve these symptoms quickly; Able to contribute to increasing the effectiveness and efficiency of health services for the general public, especially children.

In context, the Data Flow Diagram of the system is represented as in Fig. 2. Fig. 2 explains that there are 3 (three) entities in the expert system that are built namely the Admin entity as the system administrator, the general public entity as the user (user) of the system, and the pediatric entity as an expert. Each entity to input, process, and produce output from the expert system that was built. Fig. 3 gives an overview of level 0 (zero) diagram which explains that the expert system starts with process 1.p, which is logged by the admin and then continues with process 2.p, which processes data that includes data on diseases, symptoms, and rules obtained from Pediatricians. Then proceed with the process 3, namely the identification of allergic diseases in children by the general public as users of the application. Fig. 4 gives an overview of level 1 diagram (detailed) Process 3.0, which explains that process 3 in the diagram Level 0 previously broken down into 3 processes, namely the 3.1p process of child data contents, 3.2p process of decomposition of disease symptoms, and 3.3p see the results of disease identification. All of these processes are carried out by the general public as users of the application.

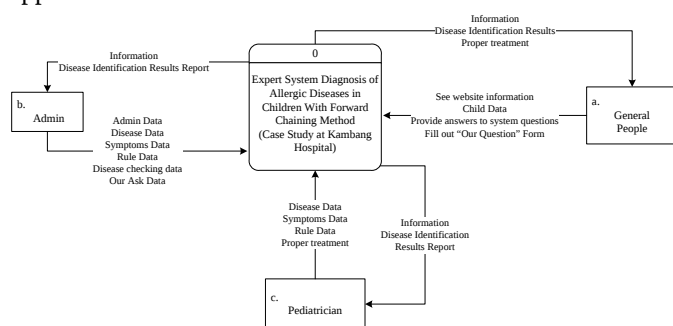


Fig. 2. Data Flow Diagram.

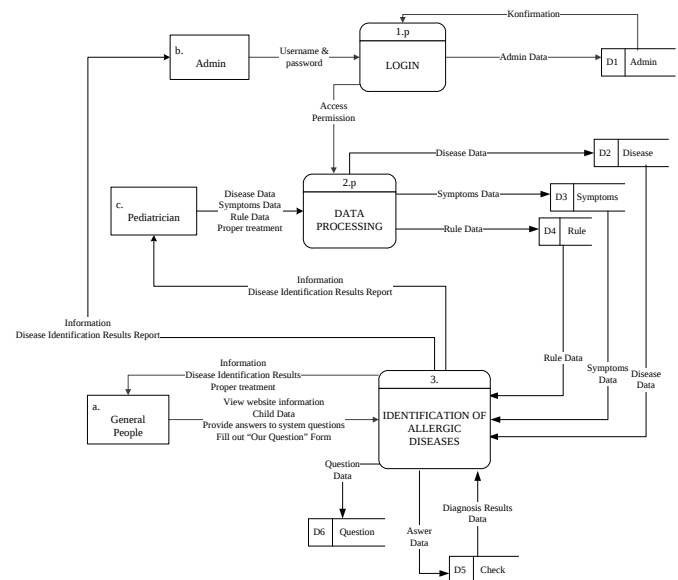


Fig. 3. An overview of Level 0 (Zero).

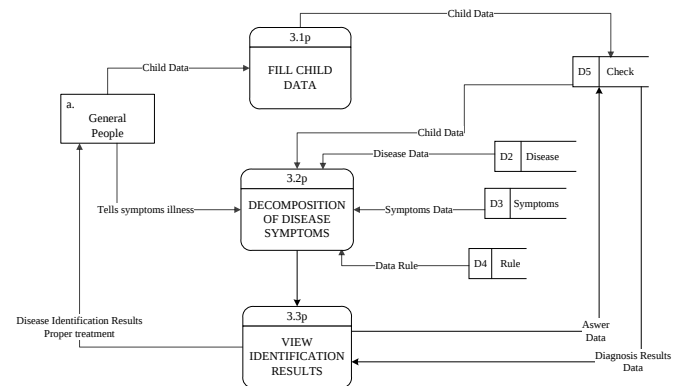


Fig. 4. An overview of Level 1 (Detail process).

Fig. 5 show the interface of the developed web application. The system built can be used properly for the Royal Prima General Hospital. This system can only be used to diagnose allergic diseases in children, but development still needs to get more accurate results. The absence of an expert system that is able to replace the temporary function of pediatricians in detecting early and providing appropriate treatment for allergic diseases in children.

With the expert system through web forward chaining for diagnosis of allergic diseases in children, it is expected to make it easier for parents to know the symptoms of allergic diseases in children and how early treatment is needed to relieve these symptoms quickly. The detection process can be done at any time, anywhere, and at any time.

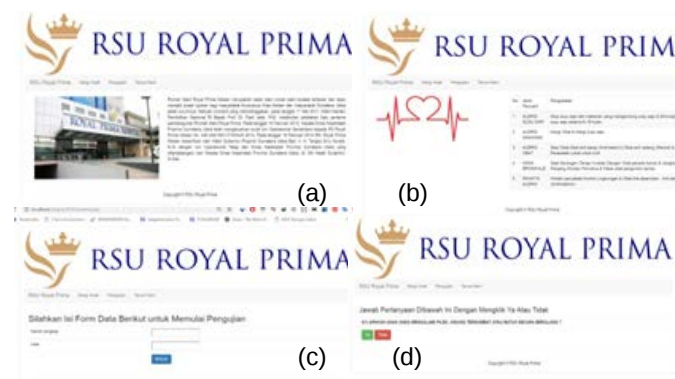


Fig. 5. Main Menu (a) Home, (b) Child Allergy, (c) Initial Testing, (d) Final Testing.

IV. CONCLUSIONS

The results of tests that have been done previously obtained the percentage of interpretation of 89.2%. It can be seen that the expert system of diagnosing diseases in smokers with a web-based forward chaining method is approved and beneficial to the community. Based on user responses, the expert system built can be easily operated, as well as providing easy-to-understand information about related diseases.

ACKNOWLEDGMENT

This research was supported by Department of Electrical Engineering, Universitas Padjadjaran, and Engineering and Computer Science, Universitas Adiwanaga Jambi, Indonesia.

REFERENCES

- [1] S.J. Russel and P. Norvig, *Artificial Intelligent: a Modern approach*. Pearson Education Limited, 2016.
- [2] M. Sivaram, et al., "Expert System in Determining the Quality of Superior Gourami Seed Using Forward Chaining-Based Websites." *Emerging Technologies in Computer Engineering: Microservices in Big Data Analytics*, pp 310-321, 2019.
- [3] A. Nuryanto, G. Amalia, D. Khairani, H. Pramono, D. Bhagawati, "Molecular characterization of four giant gourami strains from Java and Sumatra," *Biodiversitas J. Biol. Divers.* vol. 19, no. 2, pp. 528-534, 2018.
- [4] A. A. Kenari, G. V.D. Kraak, "The effects of dietary arachidonic acid on the calcium, cortisol and thyroid hormone levels in vitellogenesis and maturation stages of female Blue gourami (*Trichopodus trichopterus*, Pallas, 1770)," *Fish. Sci. Technol.* vol. 7, no. 2, pp. 17-18, 2018.
- [5] J. Slembrouck, et al., "Gender identification in farmed giant gourami (*Osphronemus goramy*): a methodology for better broodstock management," *Aquaculture*, vol. 498, pp. 388-395, 2019.
- [6] S. Abadi, et al., "Hazard level of vehicle smoke by fuzzy multiple attribute decision making with simple additive weighting method," *Int. J. Pharm. Res.*, vol. 10, no. 4, 2018.
- [7] M. Muslihudin, Trisnawati, A. Latif, S. Ipinuwati, R. Wati, A. Maseleno, "A solution to competency test expertise of engineering motorcycles using simple additive weighting approach," *Int. J. Pure Appl. Math.* vol. 118, no. 7, pp. 261-267, 2018.

- [8] J. W. Moore and L. M. Quintero, "Comparing Forward And Backward Chaining in Teachingolympic Weightlifting," *Journal of AppliedBehavior Analysis*, vol. 52, pp. 50-59, 2019.
- [9] E. Boyer, R. G. Miltenberger, C. Batsche, and V. Fogel, "Video modelling by experts with video feed-back to enhance gymnastics skills," *Journal of Applied Behavior Analysis*, vol. 42, pp. 855-860, 2009.
- [10] H. Ali, *Sistem Informasi Manajemen Berbasis Teknologi Informasi* (Management Information System Based on Information Technology). Yogyakarta: Hasta Cipta Mandiri, 2010.
- [11] R. Arief, *Pemrograman Web Dinamis menggunakan PHP dan MySQL* (Dynamic Web Programming using PHP and MySQL). Yogyakarta: CV.Andi Offset, 2011.
- [12] N. Jarti and R. Trisno, "Sistem Pakar Diagnosa Penyakit Alergi Pada Anak Berbasis Web Dengan Metode Forward Chaining Di Kota Batam (Expert System to Diagnose Allergic Diseases in Children Web-Based Using Forward Chaining Method in Batam City)," *Jurnal Edik Informatika*, 2017.
- [13] N. Rachmawati and A. Ulinuha A, *Sistem Pakar untuk Diagnosis Penyakit Jantung dengan Metode Forward Chaining Berbasis Desktop* (Expert System for Heart Disease Diagnosis with Desktop-Based Forward Chaining Method): Universitas Muhamadiyah Surakarta, 2014.
- [14] B. Raharjo, *Membuat Database Menggunakan MySQL* (Creating a Database Using MySQL). Bandung, Informatika, 2011.
- [15] T. Sutabri, *Analisa Sistem Informasi* (Information Systems Analysis). Yogyakarta. CV. Andi Offset, 2012.
- [16] Sutojo, *Kecerdasaan Buatan* (Artificial intelligence). Yogyakarta: CV. Andi Offset, 2011.
- [17] A. A. L. C Amarathunga, E.P.W.C. Ellawala, G.N. Abeysekara, and, & C.R.J. Amalraj, "Expert System for Diagnosis Of Skin Disease," *International Jurnal Of Scientific & Technology Research*, vol. 4, no. 1, pp. 174-178, 2015.
- [18] S. Iriani, "Penerapan Metode Backward Chaining pada Sistem Pakar Diagnosa Penyakit Tulang Manusia (Application of the Backward Chaining Method in the Expert System of Diagnosing Human Bone Diseases)," *Indonesian Journal on Networking and Security*, vol. 4, no. 1, pp. 51-55, 2015.

Adam Afriansyah received his S.Kom. degree in Informatics Engineering study program from Sekolah Tinggi Manajemen Informatika Dan Komputer (STMIK) Nurdin Hamzah Jambi, Indonesia in 2014 and his M.Kom. degree in Informatics Engineering study program from Universitas Putra Indonesia Padang, Indonesia in 2017. He currently works as a Lecturer at a private university of Universitas Adiwanaga Jambi, in the province of Jambi. His career has been to become the Head of Information Technology & Publications Administration / Head of Computer Labor / Reporting Forlap in 2018 until now.

Ade Oktarino received his S.Kom. degree in Informatics Engineering from the University of Surakarta (UNSA), Indonesia in 2010 and his M.Si. degree in Information Systems from the Jambi Nation School of Computer Science (STIKOM Dinamika Nation Jambi) in 2013. He currently works as a Lecturer at a private university of Universitas Adiwanaga Jambi, in the province of Jambi. His career ever entailed being Chairman of the Quality Assurance Institute at the Prima High School of Health Sciences in Jambi 2015-2016, the 2nd Deputy Chair at the Prima High School of Health Sciences in Jambi 2016-2017, and serving as the second vice rector at Adiwanaga University Jambi 2017-present.

Arjon Turnip received the B.Eng. and M.Eng. degrees in Engineering Physics from the Institute of Technology Bandung (ITB), Indonesia, in 1998 and 2003, respectively, and the Ph.D. degree in Mechanical Engineering from Pusan National University, Busan, Korea, under the World Class University program in 2012. He is currently work in the Technical Implementation Unit for Instrumentation Development, Indonesian Institute of Sciences, Indonesia as a research coordinator. He received Student Travel Grand Award for the best paper from ICROS-SICE International Joint Conference 2009, Certificate

of commendation: Superior performance in research and active participation for BK21 program from Korean government 2010, JMST Contribution Award for most citations of JMST papers 2011, Inventor Technology Award from Minister of RISTEKDIKTI 2015, and Bupati Samosir Award for the role and activities of Samosir Development. His research areas are integrated vehicle control, adaptive control, nonlinear systems theory, estimation theory, signal processing, brain engineering such as brain-computer interface. Dr. Arjon is chair of the IEEE Indonesia CSS/RAS Joint Chapter. He was an Editor of the Widyariset Journal and the Journal of Mechatronics, Electrical Power, and Vehicular Technology (JMEV). He is the Guest Editor at the Indonesian Internetworking Journal (IJ), the International Journal of Intelligent Engineering and Systems (IJIES), the International Journal of Artificial Intelligence (IJAI). He is a reviewer of the Journals of Neuroscience Methods, Biomedical Signal Processing & Control, International Journal of Business Intelligence & Data Mining, Computers in Biology & Medicine, Advances in Mechanical Engineering, and Journal of Biological Psychology. Currently, He is coaching several universities on writing scientific paper and research proposal.