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An Expert System for Diagnosing Monkeypox Diseases Using Forward Chaining Method by Mobile

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Abstract- Monkey pox is a disease transmitted by an animal virus. The virus is spread through direct contact with animals or from people who have been exposed to the disease. The development of technology in this era is quite rapid and is widely used as a means to improve human performance. The development of technology is currently widely used in the field of artificial intelligence. An expert system is a reasoning system that uses special knowledge to detect diseases. Today's society diagnoses itself a lot without knowing whether or not the disease is true. So this application helps to solve these problems. One of the diseases that uses artificial intelligence technology with the help of expert systems is monkey pox. In this application, the author uses the forward chaining method to form reasoning in the expert system. This method begins with collecting facts to make provisions as predicted. This application is intended to help people overcome confusion due to monkey pox while providing information to the general public about various types of diseases that exist in the community. This expert system is based on the study of literature such as texts, books, and journals. Well, from this application, users can choose the symptoms of the disease experienced by the patient, and the data will be processed to produce a diagnosis of the disease.

***Key words*–disease, expert system, monkeypox.**

I. PRELIMINARY

Monkeypox is a viral infectious disease caused by orthopoxvirus. This rare disease is quite dangerous after the outbreak of covid-19[1][2]. According to the WHO (World Health Organization), it is stated that monkey pox disease is an emergency endemic that will become a global health problem, and it is expected that more cases of this disease will be identified in the future. Based on data from the United States Centers for Disease Control and Prevention (CDC), the total cases of smallpox in the world have now reached 20,638 people in 77 countries as of July 28, 2022. Of these, the United States is the country with the most smallpox cases in the world, namely 4,638 people. Spain came in second, with a total of 3,738 people. Then, in Germany, England was 2,459 and France had a population of 2,432 and 1,837, respectively. There are also 818 people in the Netherlands. Canada and Brazil placed sixth with the same number of monkey pox cases, at 745 people [3].

The first case of monkey pox was identified in Indonesia. Through further examination, one Indonesian citizen was confirmed positive for monkey pox, with a history of traveling abroad which was suspected to be transmitted through close contact with the patient [4]. This infection of monkey pox transmission is characterized by purulent nodules on the skin and bumps in certain areas [5][6].

This rare disease originates from animals such as rats, squirrels, and monkeys that have been infected by the virus [7]. In Indonesia, there are still many people who keep animals but do not know what the animal is sick with and eventually they diagnose themselves without taking it to the vet. And in general, monkeypox disease is infected from wild animals such as rats, squirrels, and monkeys, but there can also be secondary transmission from humans. There are still many people who are confused about what symptoms are experienced by patients affected by monkeypox. For this reason, it is

important for the community to maintain the cleanliness of the environment and limit direct contact with people who are sick. And people can better understand this disease and can take action by using this application.

An expert system is a system that uses human thinking built into a system to detect a disease so that it does not go wrong and makes it easier for people or sufferers to know the symptoms. So that the handling process can also be done quickly and precisely. In this study, the forward chaining method was used. The forward chaining method has the advantage that the search will start according to the existing symptoms, so that from the symptom information, appropriate and fast treatment can be found [8][9].

Based on these problems, the formulation of the problem for this study is how to design an expert system application that is practical and easy to understand by users for disease diagnosis. Thus, the purpose of this study is to make it easier for the public to diagnose monkey pox from the symptoms experienced without having to see a doctor and provide benefits as an information medium, and develop a companion system to diagnose types of diseases in users.

II. RELATED RESEARCH

Foreign Studies

CPC Munaiseche, DR Kaparang and PTD Rompas "An Expert System for Diagnosing Eye Diseases using Forward Chaining Method" Discussions on diagnosing eye diseases use forward chaining methods to find out user acceptance of these applications through usability testing. The relationship with this journal with the research taken is that both use the forward chaining method. What will be developed from this journal by the current journal under study is from web to mobile [10].

Local Studies

Siti Nurajizah and Maulana Saputra "Sistem Pakar Berbasis Android untuk Diagnosa Penyakit Kulit Kucing dengan Metode Forward Chaining" Discussion on Diagnosing Cat Skin Diseases as a first step to applying artificial intelligence in the medical world. The relationship between this journal and the research taken is that both use the forward chaining method. What will be developed from this journal by the current journal under study is to add to its menu such as the nearest veterinarian and input advice [11].

III. RESEARCH METHODS

The data collection technique used is a literature study. The literature study is conducted through texts, books, and journals about similar research in order to compare the benefits and drawbacks of previous research.

The following are the design stages contained in this study the design of use case diagram, system activity diagrams, and the interface design of the system, which will determine the features and appearance of the system.

Use-Case Diagram

UML(unified modeling language) adalah sebuah bahasa yang berdasarkan grafik atau gambar untuk memvisualisasi, menspesifikasikan, membangun, dan pendokumentasian dari sebuah sistem pengembangan software berbasis object oriented[12]. Diagram ini juga dapat digunakan untuk mengetahui fungsi apa saja yang ada dalam sistem. Diagram kasus fraktur diagnosis sistem pakar adalah sebagai berikut:

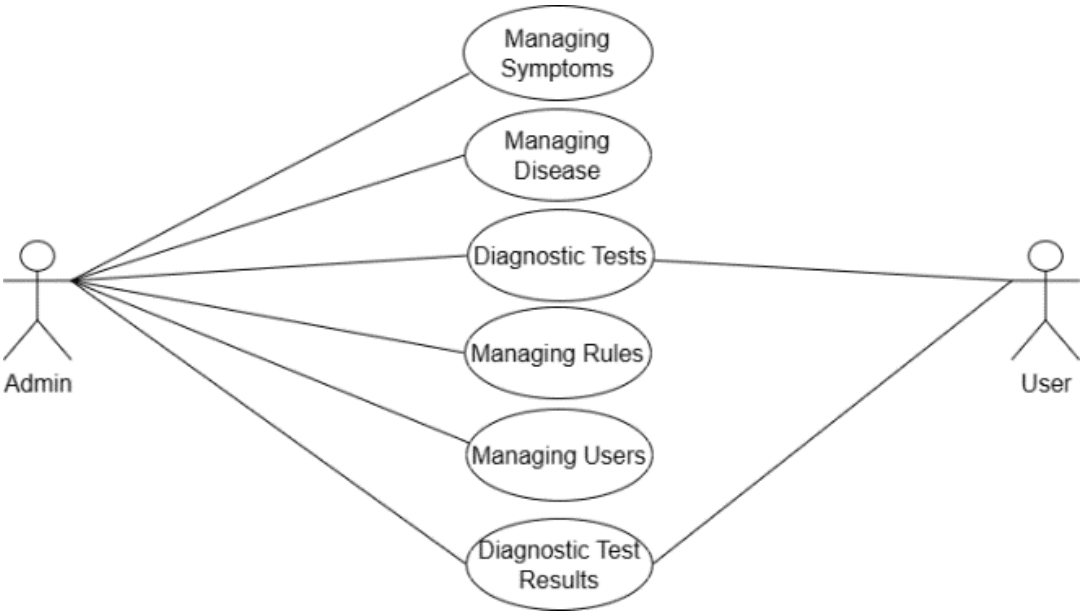


Figure 1. Use case diagrams

Activity Diagrams

Activity Diagram merupakan satu diagram alir kerja dalam sebuah sistem, berguna untuk membantu memahami aktifitas yang ada pada use case secara lebih detali dan menyeluruh. Pada penelitian ini activity diagram dibuat berdasarkan fungsi yang ada pada sistem.

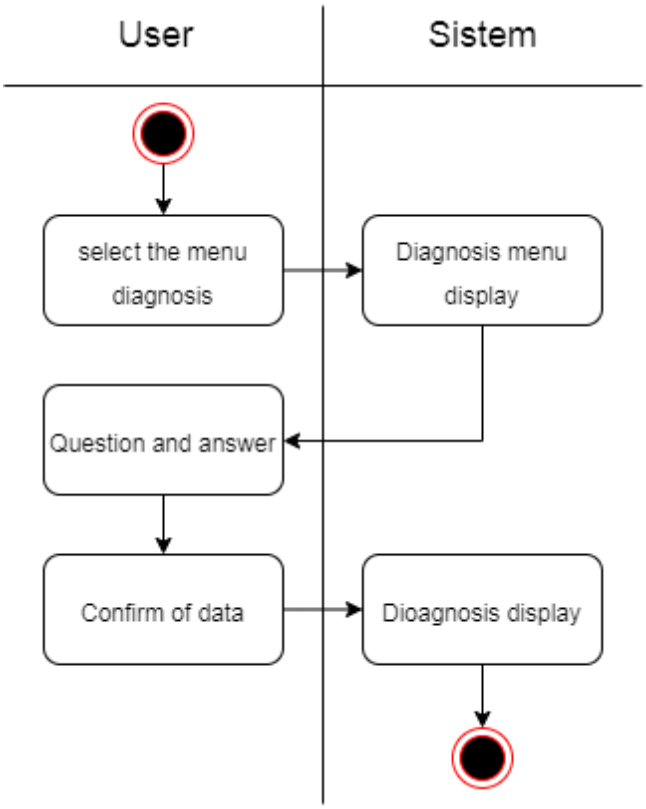


Figure 2. Diagnosis Activity diagram

The following is a flow Diagnosis Activity diagram when the user has entered the application the user will diagnose, then the system will display the diagnosis menu. Furthermore, the user will be given several questions and answer all his questions. After answering all the questions, the user will see the display of the diagnosis results.

Forward Chaining

Forward chaining is a search technique that starts with known facts and then matches those facts with the IF section of the IF-THEN rules. If there are facts that match the IF section, then the rule is executed. When a rule is executed, a new fact (THEN section) is added to the database. Each time it matches, it starts from the top rule. Each rule can only be executed once. The matching process stops when there are no more executable rules[13][14][15].

In this forward chaining, the user must answer a number of questions that have been provided by the system related to the symptoms experienced by the user. From these questions the system will draw conclusions from the symptoms experienced by the user. The forward chaining process can be seen in figure 3 below:

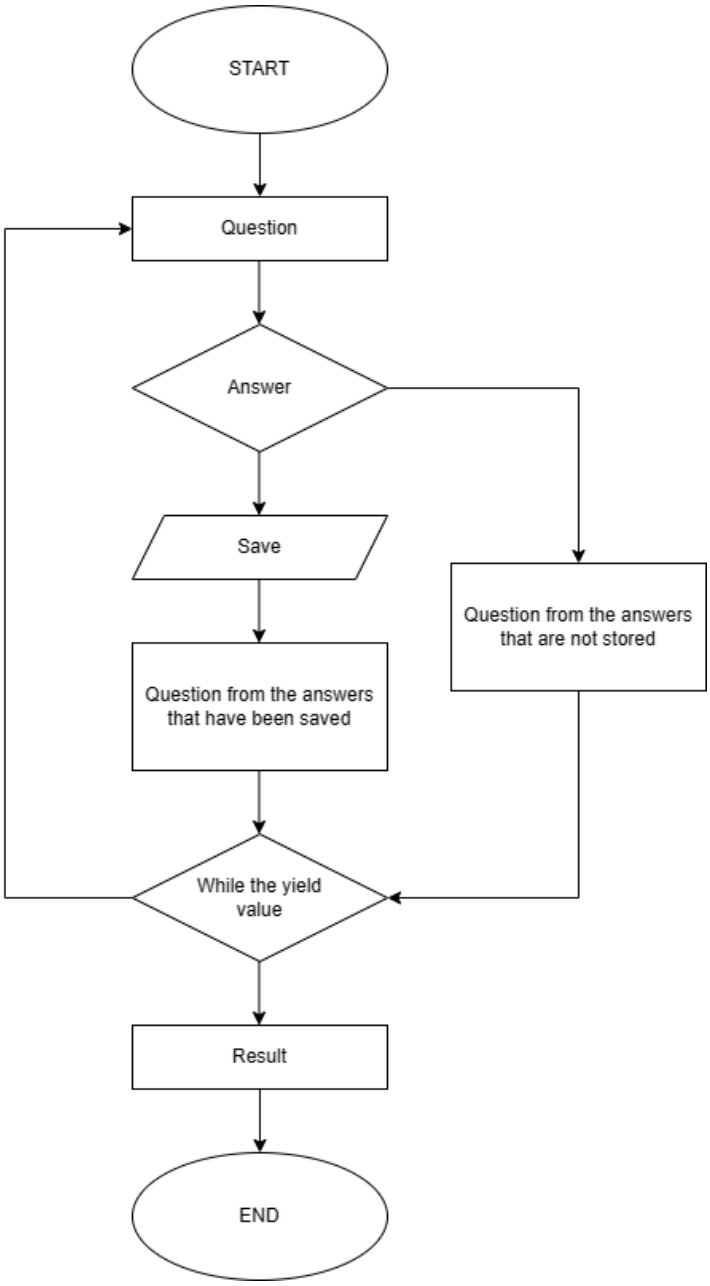


Figure 3. Forward Chaining

The following is an overview of the flowchart, starting with starting then entering the question stage, at this stage will be given several questions, if you don't answer all the questions then the data will not be saved. Then in the question session, in this question session must answer all the questions that are on the data that has been provided, then after answering all questions the data will be stored. After collecting the data, the results will come out, then it's done.

IV. RESULTS AND DISCUSSION

The observation yielded 21 symptoms and four disease data. This data will be processed for the system. In this study, a rule base was also created, which would govern the process of disease diagnosis by the system[16][17][18][19].

Table 1. Symptom Table

Symptom code	Symptom
G001	Flu
G002	Fever
G003	Cold heat
G004	Headache
G005	sore throat
G006	Pain
G007	Fatigue
G008	Nauseous
G009	Vomit
G010	Cough
G011	muscle pain
G012	Rash
G013	Itch
G014	bone pain
G015	Amused feelings
G016	burn
G017	shortness of breath
G018	Appears papules
G019	No itching
G020	Papules easily spread to skin areas
G021	When it breaks, a brass-white liquid will come out

Table 2. Table of Diseases

Code disease	Disease
H01	Chickenpox
H02	Smallpox
H03	Monkeypox
H04	Molluscum contagiosum

Table 3. Rule Base table

Code symptom	Code disease
G004, G006, G001, G016, G012	H01
G011, G014, G002, G004, G013, G015, G016	H02

G001, G011, G002, G003, G004, G005, G006, G009, G007, G008, G010	H03
G018, G019, G020, G021	H04

Rules are written in the form of IF-THEN. This rule can be said to be a two-part implementation relationship, namely the premises part (if) and the conclusion part (then). If the premise part is met then the conclusion part will be true. A rule consists of clauses similar to a subject sentence, a verb and an object stating a fact. There is a promise clause and a conclusion clause on a rule, there is also a rule consisting of several promises and several conclusions. Between promise and conclusion can relate to "OR" or "AND".

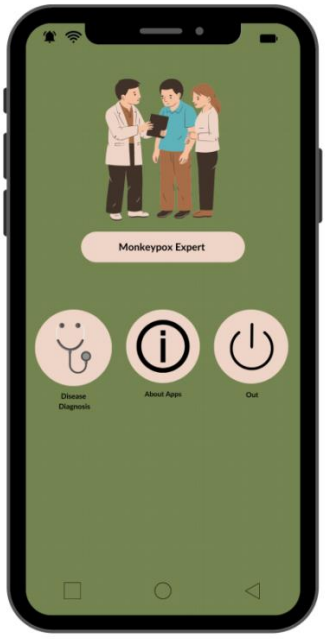
Table4. Question table on the disease diagnosis menu

No.	List of questions
1.	Do you have a fever?
2.	Do you have a headache?
3.	Do you feel pain in the spine?
4.	Do you have the flu?
5.	Do you feel dyspnea?
6.	Is there a rash on the skin?
7.	Do you feel myalgia?
8.	Do you feel pain in the bones?
9.	Do you have itchy on your skin?
10.	Do you have a tingling sensation?
11.	Does the skin feel burnt?
12.	Do you have a sore throat?
13.	Do you have a cough?
14.	Do you feel nauseous?
15.	Do you also have vomiting?
16.	Do you feel tired?
17.	Are there small bumps growing on your skin?
18.	Does it itch on your skin?
19.	Do the lumps spread to the folds on the body?
20.	Does brass liquid leak when it breaks?

In the table above are some of the table of questions that will be displayed in the application. The language used is a language that is easy to understand with the user, so that the user does not need to be confused to answer his questions.

User Interface Design

Interface is one of the services provided by the operating system as a means of interaction between the user and the operating system. The interface of the application is as follows:



Picture4. Home page

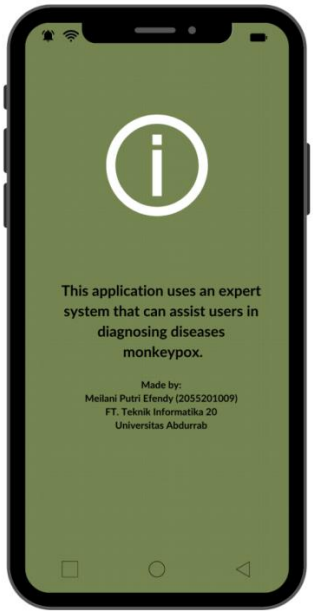
The main menu of this application has three menus, namely the diagnosis menu, about this application and exit. In the diagnosis menu, the user will diagnose directly with the expert system, while the menu about the application will display the definition of the application and credits, then the exit menu on this menu the user will exit the application.

Picture 5. Diagnosis menu

In the diagnosis menu, the user will answer all the questions that will be given to the user by pressing the right button if it is bernar and wrong if it is wrong. In this menu the user must answer all his questions otherwise it will return to the first question.

Picture 6. Diagnosis results

After the user answers all the questions, the user will know the results. When the results come out, the user can immediately see a doctor immediately so that the smallpox disease can be treated quickly.



Picture 7. About Application

In the view about this application the user will see the meaning of this application and the credit of this application.

V. CONCLUSION

Based on the design and implementation of an expert system for the diagnosis of monkey pox using the forward chaining method, it can be concluded as follows:

1. This expert system of diagnosing monkey pox using the forward chaining by mobile method is quite helpful in diagnosing the initial monkey pox disease felt by ordinary people.
2. This system is very helpful for everyone because it can be used by many people at any time and at any time, because it is application-based and can be a solution for the community.

BIBLIOGRAPHY

[1] M. Yang and M. Manusia, "Studi dan tatalaksana terkait penyakit cacar monyet (monkeypox) yang menginfeksi manusia," vol. 11, no. 3, pp. 201–208, 2022.

[2] H. P. Gumandang, "Monkeypox Disease: Wabah Multi-Nasional Monkeypox Disease: Multi-Nasional Outbreak," *J. Kesehat. Saintika Meditory*, vol. 5, no. 1, pp. 30--36, 2020, [Online]. Available: https://jurnal.syedzasaintika.ac.id

[3] World Health Organization, "2022 Mpox (Monkeypox) Outbreak: Global Trends," *World Health Organization.* [Online]. Available: 2022 Mpox (Monkeypox) Outbreak: Global Trends (shinyapps.io). [Accessed: 21-Des-2022].

[4] P. Weraman, A. U. Roga, J. M. Ratu, and S. P. Manongga, "Edukasi Protokol Kesehatan Untuk Pencegahan Penyebaran Penyakit Menular Monkeypox Pada Kelompok Lanjut Usia Di Sikumana Kupang," vol. 6, no. 3, pp. 29–34, 2022.

[5] J. Kwong *et al.*, "Monkeypox Virus Outbreak 2022 : Key," vol. 33, no. 6, pp. 657–667, 2022.

[6] D. D. Luthfiani, P. Sianturi, Ali Kusnanto, and H. Sumarno, "Pengaruh Laju Penularan Penyakit Dan Rata-Rata Kontak Individu Pada Model Ko-Infeksi Hiv/Aids Dan Cacar Monyet (Monkeypox)," *J. Math. Its Appl.*, vol. 18, no. 1, pp. 29–39, 2022, doi: 10.29244/milang.18.1.29-39.

[7] S. E. Programme, "Vaccines and immunization for monkeypox," no. June, pp. 1–28, 2022.

[8] A. Sembiring, S. Andryana, and A. Gunaryati, "Sistem Pakar Berbasis Mobile Untuk Diagnosis Penyakit Ginjal Menggunakan Metode Forward Chaining," *JIPI (Jurnal Ilm. Penelit. dan Pembelajaran Inform.*, vol. 6, no. 1, pp. 139–148, 2021, doi: 10.29100/jipi.v6i1.1932.

[9] I. Adi Pribadi, A. Adi Candra, and A. Azriansyah, "Sistem Pakar Diagnosa Penyakit Kambing Menggunakan Metode Forward Chaining Berbasis Android," *J. Pepadun*, vol. 2, no. 3, pp. 403–411, 2021, doi: 10.23960/pepadun.v2i3.83.

[10] C. P. C. Munaiseche, D. R. Kaparang, and P. T. D. Rompas, "An Expert System for Diagnosing Eye Diseases using Forward Chaining Method," *IOP Conf. Ser. Mater. Sci. Eng.*, vol. 306, no. 1, 2018, doi: 10.1088/1757-899X/306/1/012023.

[11] S. N. dan M. Saputra, "SISTEM PAKAR BERBASIS ANDROID UNTUK DIAGNOSA PENYAKIT KULIT KUCING DENGAN METODE FORWARD CHAINING," *J. Ilm. Rekayasa dan Manaj. Sist. Inf.*, vol. 4, no. 2, p. 110, 2018, doi: 10.24014/rmsi.v4i2.5678.

[12] Y. Kurniawan, "Model Sistem Informasi Manajemen Sekolah Berbasiskan Notasi Unified Modeling Language," *ComTech Comput. Math. Eng. Appl.*, vol. 4, no. 2, p. 1128, 2013, doi: 10.21512/comtech.v4i2.2572.

[13] F. Masya, "Application Design to Diagnosis of Bone Fracture (Traditional) using Forward Chaining Methods," vol. 3, no. September, pp. 23–30, 2016.

[14] R. A. Prayuda, D. A. Prastiningtyas, and A. Tirtana, "Sistem Pakar Diagnosa Penyakit Pada Kucing Menggunakan Metode Forward Chaining Berbasis Android," *J-Intech*, vol. 9, no. 02, pp. 70–78, 2021, doi: 10.32664/j-intech.v9i02.557.

[15] A. A. Pramesti, R. Arifudin, and E. Sugiharti, "Expert System for Determination of Type Lenses Glasses Using Forward Chaining Method," *Sci. J. Informatics*, vol. 3, no. 2, pp. 177–188, 2016, doi: 10.15294/sji.v3i2.7914.

[16] P. Le and M. Rothberg, "Herpes zoster infection," *BMJ*, vol. 364, no. January, pp. 2–7, 2019, doi: 10.1136/bmj.k5095.

[17] A. K. . Leung, B. Barankin, and K. L. . Hon, "Molluscum Contagiosum: An Update," *Recent Pat. Inflamm. Allergy Drug Discov.*, vol. 11, no. 1, 2017, doi: 10.2174/1872213x11666170518114456

[18] K. Julian and B. Bodaghi, "Varicella-zoster virus," *Intraocular Inflamm.*, vol. 9, no. 3, pp. 1227–1238, 2016, doi:

10.1007/978-3-540-75387-2_117.

[19] J. Joshua and P. Nlerum, “A Neuro-Fussy Based Model for Diagnosis of Monkeypox Diseases A Neuro-Fussy Based Model for Diagnosis of Monkeypox Diseases,” no. May, 2018.