

Expert System Detecting Symptoms of Game Addiction with The Forward Chaining Method and Certainty Factor

1st Muhammad Mujib Al Khafid
Information System Department
Faculty of Computer Science
University of Duta Bangsa Surakarta

2nd Sri Sumarlinda
Information System Department
Faculty of Computer Science
University of Duta Bangsa Surakarta

3rd Rina Arum Prastyanti
Information System Department
Faculty of Computer Science
University of Duta Bangsa Surakarta

Abstract—Games are fun playing activities. In the past, most children and adolescents played games with physical activities, but nowadays children and adolescents play games with their gadgets. Excessive gaming activity can lead to addiction. Game addiction can cause mental illness, even physical illness. This study aims to help gamers as well as the general public to better understand the symptoms of game addiction and early solutions to game addiction. This study uses forward chaining as a plot, namely by collecting symptoms to find the level of addiction and certainty factors as a calculation by calculating the level of trust and distrust of symptoms. In this study, game addiction resulted in 3 levels, low level game addiction, medium level game addiction and high level game addiction.

Keywords—*expert system, forward chaining, certainty factor, game addiction*

I. INTRODUCTION

Game is a type of game or match model. games can be defined as structured or semi-structured activities, which are usually done for fun and sometimes used as a learning tool [1]. The game is one type of activity to play with the players trying to achieve the goals of the game by taking action according to the rules of the game [2]. Playing online games can give negative impact both socially, psychologically and physically. Teens who play online games, socially relations with family and friends are reduced, cause socialization of teenagers only in online games. Impact psychologically, adolescents are experiencing addiction will continue to think of frequently played, difficult games concentrate on studying or work, doing whatever it takes to be able to play game again, and is physically exposed to continuous light exposure to computer radiation can continuously damage the nerves of the eye and brain[3].

An expert system is a system whose performance adopts the expertise of an expert in a particular field into a computer system or program that is presented with a display that can be used by users who are not experts so that the system users can use it. make a decision or determine a policy like an expert[4]. Expert system is needed because it contains the knowledge and experience of many experts in certain fields of knowledge. The implementation of expert systems is widely used in the health sector, for example psychiatric disorders (psychological) such as diagnosing an addiction or addiction. Diagnosis is done to explain whether a person is experiencing / suffering from certain diseases such as psychological illnesses such as addiction to games. To make it easier to diagnose symptoms of addiction to games, the Certainty Factor and forward chaining methods are used.

Forward Chaining is a decision-making method commonly used in Expert Systems. The search process with the Forward Chaining method departs from left to right, namely from the premise to the final conclusion, this method

is often called data driven, namely the search is controlled by the data provided. Forward Chaining is also called forward reasoning, namely the rules are tested one by one in a certain order. The inference engine will match the facts or statements in the knowledge base with the situations stated in the IF rule. If the facts in the Knowledge Base are in accordance with the IF rules, then the rule is stimulated and the next rule is tested. The process of testing one rule at a time continues for a complete loop through all sets of rules [5].

Certainty factor is a clinical parameter value given by MYCIN to show a measure of the certainty of a fact or rule. CF shows a measure of the certainty of a fact or rule. Certainty factor uses a value for Observation A Rule R1 fact A Rule R3 New fact Observation B Rule R2 fact B Rule R2 Fact c conclusion 17 assumes the degree of an expert's confidence in a data. Certainty factor for rules with similar conclusions (similarly concluded rules):

$$CF \text{ COMBINE } (CF1, CF2) = CF1 + CF2 * (1-CF1)$$

The Certainty factor formula is defined as the following equation:

$$CF(H, E) = MB(H, E) - MD(H, E)$$

$$MB(h, e1 \wedge e2) = MB(h, e1) + MB(h, e2) * (1-MB[h, e1])$$

$$MD(h, e1 \wedge e2) = MD(h, e1) + MD(h, e2) * (1-MD[h, e1])$$

Information:

CF (H, E): Certainty Factor from hypothesis H which is influenced by symptoms (evidence), the amount of CF ranges from -1 to 1. A value of -1 indicates absolute distrust while a value of 1 indicates absolute trust. MB (H, E): measure of increased belief against hypothesis H which is influenced by the E phenomenon. D (H, E): a measure of increased disbelief to hypothesis H which is affected by symptoms [6].

II. METHOD

Method of collecting data

This study, researchers used primary data obtained at the time of interview while secondary data was obtained indirectly. Secondary data is in the form of written reports, journals, papers, documents, and bibliography related to research.

a. Interview

The interview method was conducted with related health experts, namely dr. Aliyah Himawati R, SpKJ from the Surakarta Mental Hospital, to seek information regarding the identification of mental health problems so that the data is more accurate.

b. Literature Study

The author conducted a literature study to collect references related to making expert system applications.

Systems Development Method

The method chosen in this study is the Prototype method. Prototype is defined as a system development method starting from collecting customer needs and then creating a prototype program that the customer wants which contains a flow view of the program to be made. The prototype program is evaluated by the customer until the specifications meet customer requirements. The stages of software development using this prototyping model involve the following activities:

Building prototyping

Building prototyping is the stage of compiling data, testing the validity by a psychology specialist. Making expert system rules, as well as designing an expert system to be made.

Evaluation of prototyping

Evaluation which is done is evaluation of system design that will be made. The system design that has been approved will be followed by the fourth step, namely coding the system, if not then revising it again.

Coding the system

Coding the system is the stage of translating the approved expert system design into the PHP and MySQL programming languages.

Testing the system

The system as an application program that is ready for use, must be tested before being used, as a consideration for whether the system is already running according to the system design or there are still errors in the system.

Evaluation of the user

system evaluates whether the application program system to be used is in accordance with the needs [7].

III. RESULT

A. Name f disease, symptom, MB, Md and Solution

Based on the results of data collection by the author in the form of interviews and literature studies that have been approved by dr. Aliyah Himawati R, SpKJ and can be seen in table 1:

Table 1. Name f disease, symptom, MB, Md and Solution

No	Name of Disease	Symptom	MB	MD	Solution
1.	Low level gaming addiction	Excessive game play, in 1 day more than 3 hours	0,8	0,2	Doing positive activities, maintaining communication, and maintaining physical and mental health
		Interferes with education or work, as well as disturbing one's relationship with family or the surrounding environment.	0,8	0,1	
		You play the game secretly so that other people don't know	0,7	0,04	
		Play games to rid yourself of unpleasant thoughts	0,9	0,02	
2	Moderate game addiction	Have had a conflict with your family, friends, or partner because of gaming	0,6	0,1	Determine the meaning and purpose of life, communicate with the closest people and others, and balance it with positive activities
		Prioritizing the game above the main task	0,8	0,2	
		Continue to play the game even if there are negative consequences	0,7	0,02	
		Have no other desire or interest to do other than playing games	0,6	0,02	
3	High Level game addiction	Cannot control gaming habits	0,9	0,1	Look for the closest person to always remind you to reduce the time to use gadgets, focus on what you can achieve and your life goals, turn your attention to positive activities or seek to gather with other people, worship a lot and devote yourself to God Almighty. If the advice has been tried but has not had an impact on reducing your addiction, please come to psychology for consultation
		Difficulty in reducing game play time despite physical problems	0,8	0,02	
		Feeling restless if you don't play games a day, irritability, behavioral disorders such as sleep disorders, eating and self-care	0,9	0,1	
		The above symptoms last for 12 months or more	0,9	0,1	

B. Rule

To represent knowledge used the rule method which is usually written in the form (IF-THEN). The rules used in this expert system are as follows:

Table 2. Name of disease, symptom and solution

RULE 1	IF Playing games excessively, in 1 day more than 3 hours AND Interferes with education or work, as well as disturbing one's relationship with family or the surrounding environment. AND Play games to rid yourself of unpleasant thoughts THEN Low level game addiction
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RULE 2	IF Have experienced conflicts with your family, friends or spouse because of gaming AND Prioritizing the game above the main task AND Keep playing the game even if there are negative consequences AND Have no other desire or interest to do other than playing games THEN Moderate game addiction
RULE 3	IF Cannot control game play habits AND prioritize the game over the main task AND Feeling difficulty in reducing time to play games even though physical problems appear AND Feel restless if you don't play games for a day, irritability, behavioral disorders such as sleep disorders, eating and self-care AND The above symptoms last for 12 months or more THEN High-level game addiction

Sample case :

The user selects the following symptoms:

1. Have experienced conflicts with your family, friends, or partners because of games
2. Prioritize the game above the main task

Calculation of MB and MD Value:

$$MB = MB + MB (1-MB)$$

$$MD = MD + MD (1-MD)$$

$$MB1 = 0.6 + 0.6 (1-0.6)$$

$$= 0.84$$

$$MD1 = 0.1 + 0.1 (1-0.1)$$

$$= 0.19$$

$$MB2 = 0.8 + 0.8 (1-0.8)$$

$$= 0.96$$

$$MD2 = 0.2 + 0.2 (1-0.2)$$

$$= 0.36$$

$$CF = MB-MD$$

$$CF1 = 0.84-0.19$$

$$= 0.65$$

$$CF1 = 0.96-0.36$$

$$= 0.65$$

Symptoms combined with certainty factor values:

$$CF1 = CF1 + [CF2 * (1-CF1)]$$

$$= 0.65 + [0.6 * (1-0.65)]$$

$$= 0.65 + [0.6 * 0.35]$$

$$= 0.86$$

$$= 86\%$$

Usecase Diagram

The following is a description of defining actors in the game addiction diagnosis application:

Table 3. Actor description

Actor	Description
Admin	Person entitled to manage symptom, disease and solution data
User	People who have the right to make a diagnosis according to the results of the application question

Defining the management of actor interactions on the system, is described in the following table:

Table 4. usecase identification

No	Use case	Description
1.	Login	Entering username and password for admin
2.	User Registration	User registration by filling out the biodata form
3.	Conducting Consultation	Is a consultation process by answering several questions
4.	Managing Symptom Data	Is the process of adding data on the symptoms of game addiction
5.	Manage disease data and solutions	Is the process of adding disease data and solutions
6.	Manage disease relations, symptoms and value beliefs	It is the process of adding data on the relationship between disease and symptoms of game addiction and the value of data confidence
7.	See Test Results	Is a process in which data that has been tested provides diagnostic results
8.	Log Out	Is the process of returning to the main page

The following is a system design use case diagram:

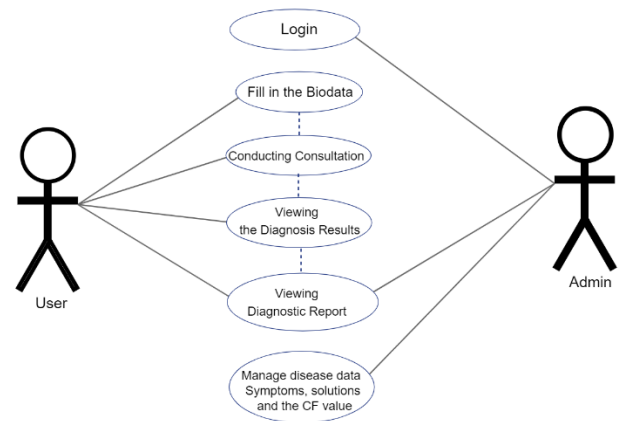


Fig.1. System design usecase diagram

c. Tabel Relation

At this stage, it contains a relationship table of diseases, a table of symptoms, a table of solutions, a table of relations of symptomatic diseases, a table of relation to disease solutions, and a user table.

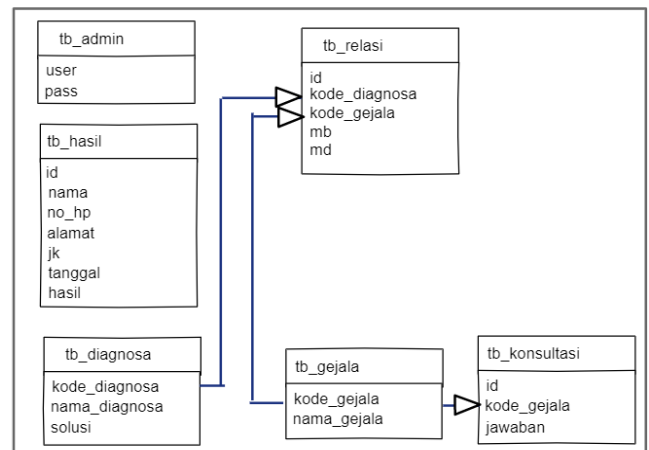


Fig.2. Tabel Relation

Implementation

a. Expert Interface Implementation

The interface implementation contains a display on the monitor screen that makes it easier for users to use the system to be created. The input and output displays on this expert system are as follows:

1. Login

This view is used by the admin to enter the system. The following views of the login page can be seen as follows:



Fig.3. Login

2. Admin Home Page

The admin home page features at-a-glance information slides regarding diseases, symptoms, knowledge base, reports. Here is what the admin home page:



Fig.4. Admin home age

3. Disease Data page

The disease data page is used to manage the level of disease in this expert system. The page views of the disease are as follows:

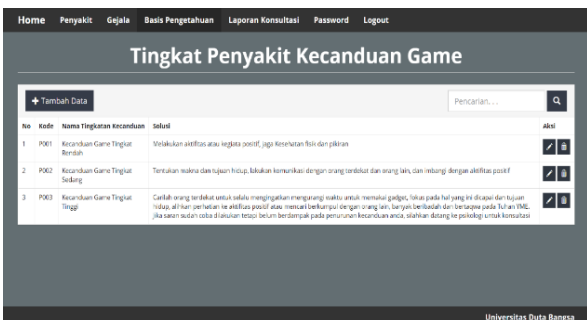


Fig.5. Disease data page

4. Symptom Data page

The symptom data page is used to manage the symptoms of game addiction in this expert system. The symptom page displays are as follows:



Fig.6. Syptom data page

5. Knowledge Base page

Used to manage the value of MB and MD and the relationship between disease and symptoms. The displays can be seen as follows:



Fig.7. Knowledge base page

6. Report Page

The report page serves to display data on the results of consultations carried out by users.

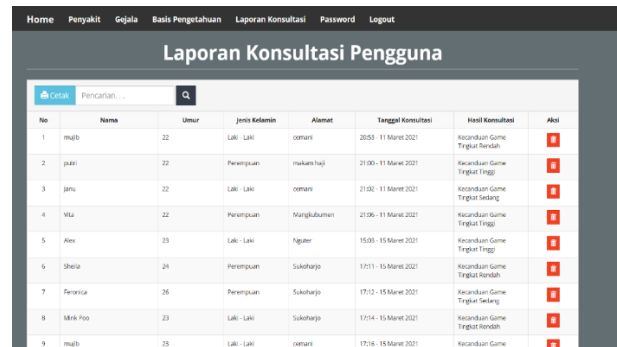


Fig.8. Report page

b. User Interface

1. Home

The user home page displays the consultation page.

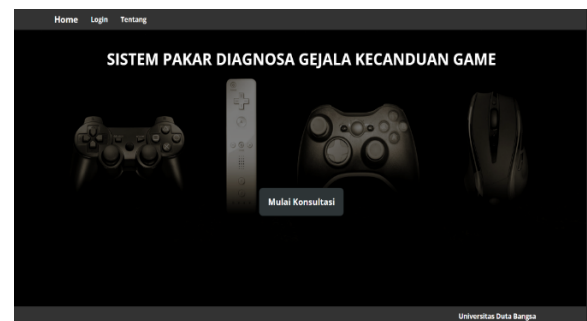


Fig.9. home user

2. Information Page

The information menu page on the customer contains information about the level of game addiction.

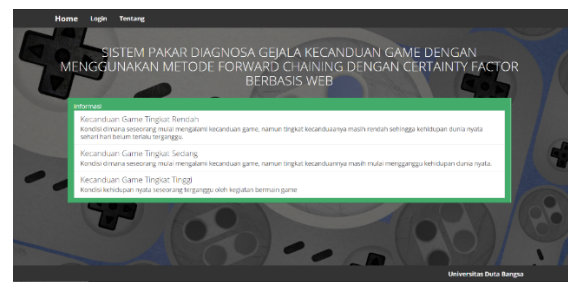


Fig.10. home user

3. Biodata Menu Page

The data biodata menu page is used to fill in the user's bio.

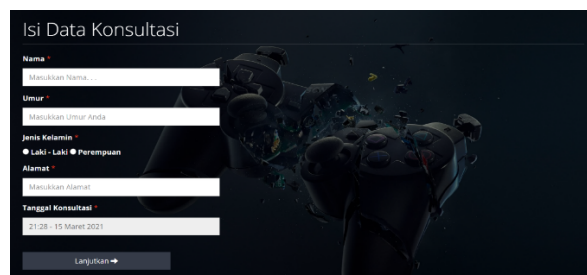


Fig.11. home user

4. Consultation Question Menu Page

The consultation question menu page is used for consultation for users by answering questions. One of the views of the consultation page can be seen as follows:

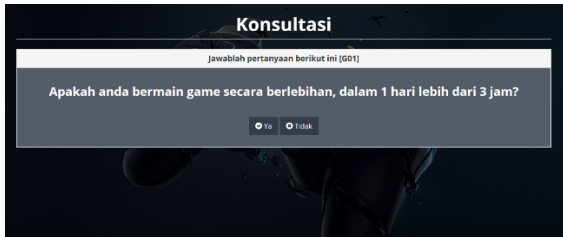


Fig.12. Consultan Question

5. Display of Consultation Results

The consultation results page serves to display the results of the consultations carried out by the user. The following is a page view of the consultation results:

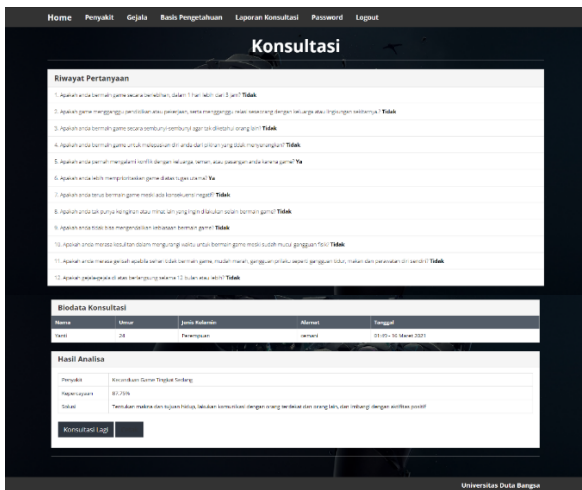


Fig.13. Consultan Question

c. Testing The System

In testing this black box using several cases to check whether the system is running well. The following is a table of cases along with the results of the system test:

Table 5. Testing On User Systems

Case	Goal	Result	Information
Enter The System	Displaying the home page	Displays the home page and gets access to all menus	Work
Access the About menu	Displaying the information page	The system can display information pages	Work
Access the Biodata menu	Displaying the biodata page	The system can display the user's bio page	Work
Choose the next button	Displays a symptom question form	Can display the question form	Work
Access the results menu	Displays the consultation results page	The system can display the results of the consultation	Work

Table 6. Testing On Admin Systems

Case	Goal	Result	Information
Login	Displays the admin home page	Displays the admin home page and gets access to all menus	Work
Access the Disease menu	Displays the Disease data page	The system can display the level of disease data page	Work
Choose the add button	Displays the added disease form	Can display the form added disease data and can save to the database	Work
Access the symptom menu	The system can display a symptom page	The system can display a symptom page	Work
Choose the add symptom button	Displays the added symptom form	Can display the form added symptom data and can save to the database	Work
Access the Knowledge Base menu	Displays the knowledge base page	The system can display the knowledge base page	Work
Select the add knowledge base button	Displays the form add knowledge base	Can display the form to add knowledge base data and can save to the database	Work

IV. CONCLUSION

Expert systems are developed using the forward chaining method, and calculated using a certainty factor. The system can classify the level of game addiction as expected so that it can help users a little to reduce excessive gaming activities. System testing uses blackbox and all functions can run.

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