

Expert System for Diagnosing the Level of Online Game Addiction in Malikussaleh University Students with Certainty Factor Method

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Abstract

Online gaming has become one of the most popular forms of entertainment, especially among university students. However, online game addiction can have negative impacts such as social isolation and mental health disorders. This research aims to design and build an expert system that can diagnose the level of online game addiction in Malikussaleh University students using the Certainty Factor method. This method was chosen because it is able to measure the level of confidence in decision making based on evidence or expert judgment. The expert system developed will provide diagnoses based on the symptoms of addiction identified. This research uses primary data obtained through interviews with experts and observations, as well as secondary data from literature studies. The results of this study are that out of 250 samples of malikussaleh university student data, 44 people or 17.6% of the sample experienced mild addiction, 81 people or 32.4% of the sample experienced moderate addiction, and 125 people or 50% of the sample experienced severe addiction to online games. This shows that this expert system can be used to facilitate users in detecting the level of addiction to playing online games they suffer. The results of this study are expected to help students to know their level of addiction to online games, so that appropriate prevention and control measures can be taken. In addition, this research is also expected to contribute to the development of expert systems in the field of mental and behavioral health. Thus, this expert system can be an effective tool in diagnosing and overcoming online game addiction among students.

Keywords: System, Expert, Addiction, Certainty Factor

Introduction

The development of technology has brought interesting phenomena in human life today. Such as global culture and instant lifestyle which is the impact of the unstoppable trend of globalization. Globalization is often defined as the cultural influence of developed (leading) countries on developing (underdeveloped) countries. One of the most rapid developments in today's modern generation is the internet and gadgets. With the rapid development of technology, this affects changes in life behavior. One of them is the choice of entertainment such as games. Today's society tends to leave traditional forms of games and switch to more modern games such as online games. [1]. The factor why games are so popular is the human need for a sense of comfort and pleasure.

Online games are a type of game that can be played with a gadget connected to an internet connection. In online games, players can play games with singleplayer or solo options and can also be played with other people or multiplayer from various locations [1]. Online games can have both positive and negative impacts. The positive impact of playing online games is as entertainment to release stress, build friendships and communities, and can become career opportunities such as professional players (e-sports). Meanwhile, the negative impact is to make users addicted so that they forget time and experience social isolation. People with poor interaction traits and social skills have difficulty building relationships in the real world. Therefore, these individuals try to build relationships in the virtual world by playing online games. [2]. Playing online games also provokes users to use abusive language and disrupts psychological health and physical health.

In recent years, the popularity of online games among Malikussaleh University students has continued to increase. Malikussaleh University is an institution where the researcher and probably also many students experience the phenomenon of online game addiction. Choosing Unimal as a case study location provides a strong relevance between the research and the environment where the phenomenon occurs and also as a student at Unimal, the researcher has easier access to data from students in the environment, including to conduct surveys, observations, or data collection. This makes it easier in the process of researching and testing the expert system that you develop. Advances in technology and easier internet access have made online gaming a common activity among students. However, an increase in the duration and intensity of gaming often leads to addiction, which can have a negative impact on students' academic performance, mental health, and social interactions. [1].

Based on initial observations, many students admitted to spending hours every day playing online games, even to the point of neglecting academic assignments and social activities. This addiction phenomenon is difficult to diagnose

objectively because the signs are often underestimated by students and the campus. WHO has designated gaming addiction or gaming disorder as a mental illness. Experts at WHO added gaming addiction to the 11th International Statistical Classification of Diseases (ICD). The ICD is a system that lists diseases along with symptoms, signs and causes issued by the WHO. This gaming addiction has now been included by experts in the list of disorders due to addictive behavior. In other words, diseases caused by habit or addiction. [3].

Students who experience online game addiction can spend time playing online games for more than 2 hours per day or the equivalent of more than 14 hours per week or even 55 hours a week. [1]. From the data above, it is clear that students enjoy playing online games. Therefore, in this case special care is needed to early diagnose the level of online game addiction by an expert system and prevent students from becoming addicted to online games. Online game addiction also has several levels based on its severity including low, medium and high. To find out the level of online game addiction experienced by someone, a diagnosis must be made first. In this case, an expert is needed to diagnose the level of online game addiction through existing symptoms which then provides a way to overcome it. However, due to limitations such as limited time and cost, patients are reluctant to visit a psychiatrist. Therefore, an expert system is presented to overcome the problems that occur. For its application, the expert system has several methods, one of which is the certainty factor method or commonly known as the certainty factor. The certainty factor method is a method used in measuring the level of confidence in decision making based on evidence or expert judgment. [4]. Therefore, a system is needed that is able to diagnose the level of online game addiction in students more systematically and accurately. An expert system with the Certainty Factor method can be used to measure the level of addiction based on a number of symptoms and behaviors shown by students, thus helping to identify those who need further intervention.

Based on the description above, the author wants to conduct research with the title "**Expert System for Diagnosing the Level of Online Game Addiction in Malikussaleh University Students with Certainty Factor Method**". With this research, it is hoped that it can help students to find out the level of addiction experienced to online games which are classified in the low, medium and high categories.

Literature Review

A. Expert System

A system is a group of elements that work together (integrate) to achieve a certain goal or objective. The elements in a system cannot operate independently because all of these components need each other and are interconnected to achieve their goals.[5]. A system is a conceptual or physical entity that consists of interdependent parts. [6]. An expert is someone who has expertise in a particular field, namely an expert who has certain knowledge or abilities that are not known or cannot be mastered by others in his field. [7]. Thus, an expert system is an information system that captures and uses the knowledge and decision-making methods of one or more experts in a particular subject area. Expert systems act like experts in their field and contain facts and features to solve specific problems. Expert systems are based on knowledge systems that allow computers to draw appropriate conclusions [8]. [8] Expert System or Expert System, also known as Knowledge Based System, is a computer application that supports decision making and problem solving in certain fields. [9].

B. Online Game Addiction

Addiction can be defined as a condition where a person becomes dependent on something he likes because he loses control over his behavior in various situations and feels punished if he does not satisfy his desires or habits. [11] Online games are a type of game that can be played with a gadget connected to an internet connection. In online games, players can play games with singleplayer or alone options and can also be played with other people or multiplayer from various locations. The aspects of online game addiction are [12]:

- a. Salience, which is when playing online games is used as an activity that dominates feelings, thoughts, and behavior.
- b. Tolerance, which is when someone plays online games more often and always spends more time playing online games.
- c. Mood modification, which is a subjective experience expressed as a result of one's engagement in games.
- d. Relapse, which is the tendency to return to patterns of excessive play even after being restricted or controlled.
- e. Withdrawal, When online gaming access is reduced or restricted there are feelings of discomfort and displeasure or physical effects.
- f. Conflict, the occurrence of excessive opposition or conflict about online games both to oneself and others. This includes ignoring others to lying or cheating.
- g. Problems, the emergence of problems caused by excessive online gaming behavior due to addiction that consumes all activities, such as school, social life, or work.

C. Certainty Factor

Certainty Factor Theory is a method that shows confidence in an event (fact or hypothesis) based on evidence or expert judgment. In the certainty factor method, a value is used to assume the degree of confidence of an expert in the data. The Certainty Factor method was proposed by Shortliffe and Bunchanan in 1975 to explain the uncertainty (inaccurate reasoning) of an expert. An expert often uses phrases like "most likely" and "almost certainly" to analyze existing information. To illustrate this, the Certainty Factor is used to describe the expert's belief in the problem at hand. Here is the basic formula for the Certainty Factor method:

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

Certainty factor has several combination formulas for various conditions, namely:

1. Certainty Factor in determining single premise rules:
 $CF(H,E) = CF(H,E) * CF(rule) = CF(user) * CF(expert)$
2. Certainty Factor in determining multiple premise rules:
 $CF(A \text{ AND } B) = \text{Minimum } (CF(a), CF(b)) * CF(rule)$
 $CF(A \text{ OR } B) = \text{Maximum } (CF(a), CF(b)) * CF(rule)$
3. Certainty Factor in determining similarly concluded rules:
 $CF_{Combine} CF(H,E)_{1,2} = CF(H,E)_1 + CF(H,E)_2 * (1 - CF(H,E)_1)$

Materials & Methods

Broadly speaking, the types of data are divided into 2 groups, namely primary data and secondary data. Primary data is data obtained by collecting data directly on the research subject, including interviews with an expert, namely Mrs. Nursan Junita, BHSc., MA and observation. Secondary data is data obtained from a number of literature reviews related to the themes and problems of the research, namely, Literature Studies in this method researchers collect data or material by looking for references that are relevant to the object under study to support the description of problems in journals, the internet and theses that are strongly related to the topic of the problem.

Results and Discussion

A. System Data Requirements Analysis

The data analysis process in the expert system to diagnose the level of online game addiction in malikussaleh university students is based on information data obtained from Mrs. Nursan Junita, BHSc., MA. Psychologist, an expert in psychology through interview techniques. The data can be described as follows:

1. Data on symptoms of online gaming addiction

The symptom data needed in building an expert system to diagnose the level of online game addiction in malikussaleh university students are as follows:

Table 1. Data on Symptoms of Online Game Playing Addiction

Aspects	Symptom Code	Symptoms
Salience	G1	Thinking of playing online games all day
	G2	Spending a lot of free time playing online games
	G3	Feeling addicted to online games
Tolerance	G4	Playing online games for longer than expected
	G5	Spending more time playing online games
	G6	Can't stop once you start playing online games
Mood Modification	G7	Play online games to forget the real world
	G8	Play online games to relieve stress
	G9	Play online games for a better mood
Relapse	G10	Unable to reduce time spent playing online games
	G11	Other people cannot help in reducing online gaming time
	G12	Failed when trying to reduce time spent playing online games
Withdrawal	G13	Feel bad when you can't play online games
	G14	Feeling angry when unable to play online games
	G15	Become stressed when unable to play online games
Conflict	G16	Ever fought with others (e.g. family, friends) while spending time playing online games
	G17	Ignoring others (e.g. family, friends) because you are playing online games
	G18	Lying about time spent playing online games
Problems	G19	Time spent playing online games results in sleep deprivation
	G20	Neglecting other activities (e.g. school, work, sports) to play online games
	G21	Feeling unwell or tired after playing online games for long periods of time

2. Data on symptom weight values from experts

Expert weight value data is very influential in the diagnosis process. This weight data is data on the expert's level of belief in the symptoms of addiction to playing games which is calculated in the form of a CF value. The following is the weight data from the results of the expert interview.

Table 2. Data of Symptom Weight Value from Expert

Symptom Code	Symptoms	CF Expert
G2	Spending a lot of free time playing online games	0,6
G3	Feeling addicted to online games	0,6
G4	Playing online games for longer than expected	0,6
G8	Play online games to relieve stress	0,6
G10	Unable to reduce time spent playing online games	0,6
G18	Lying about time spent playing online games	0,6
G21	Feeling unwell or tired after playing online games for a long period of time	0,6
G6	Can't stop once you start playing online games	0,8
G7	Play online games to forget the real world	0,8
G9	Play online games for a better mood	0,8
G11	Other people cannot help in reducing online gaming time	0,8
G17	Ignoring others (e.g. family, friends) because you are playing online games	0,8
G19	time spent playing online games results in sleep deprivation	0,8
G20	Neglecting other activities (e.g. school, work, sports) to play online games	0,8
G1	Thinking of playing online games all day	1
G5	Spending more time playing online games	1
G12	Failed when trying to reduce time spent playing online games	1
G13	Feel bad when you can't play online games	1
G14	Feeling angry when unable to play online games	1
G15	Become stressed when unable to play online games	1
G16	Ever fought with others (e.g. family, friends) while spending time playing online games	1

3. Online Game Addiction Rate Data

The addiction category data needed in the expert system to diagnose online game addiction is as follows:

Table 3. Online Game Addiction Level Data

Addiction Code	Addiction Level
K1	Low Addiction
K2	Moderate Addiction
K3	High Addiction

4. Rule data

The rules used in this expert system to detect the level of online game addiction use the forward chaining inference method. The following is rule data based on the results of expert interviews:

Table 4. Rule

Rule	Addiction Level
IF(G2, G3, G4, G8, G10, G18, G21) THEN	Low Addiction
IF(G6, G7, G9, G11, G17, G19, G20) THEN	Moderate Addiction
IF(G1, G5, G12, G13, G14, G15, G16) THEN	High Addiction

B. Certainty Factor Calculation

The following is an example of a manual calculation of the online game addiction diagnosis case where the patient will provide answers in the form of the options listed according to his level of confidence.

- G2 : Spend a lot of free time playing online games
- G4 : Playing online games for longer than expected
- G5 : Spend more time playing online games
- G8 : Playing online games to relieve stress
- G9 : Play online games for a better mood
- G10 : Unable to reduce online gaming time

- G15 : Become stressed when unable to play online games
- G17 : Neglecting others (e.g. family, friends) because of playing online games

Table 5. CF Value Data

Answer	weight
Never	0
Rare	0,4
Sometimes	0,6
Often	0,8
Very often	1

Patients provide answers in the form of belief values for the symptoms they experience or feel. The patient belief data can be seen in the table below.

Table 6. Example CF Value Data

Code	Symptoms	CF User
G2	Spending a lot of free time playing online games	0,4
G4	Playing online games for longer than expected	0,6
G5	Spending more time playing online games	0,6
G8	Play online games to relieve stress	0,6
G9	Play online games for a better mood	0,6
G10	Unable to reduce time spent playing online games	0,6
G15	Become stressed when unable to play online games	0,4
G17	Ignoring others (e.g. family, friends) because you are playing online games	0,4

Furthermore, the symptoms above will be calculated using the certainly factor method as follows:

$$CF(H,E) = CF(USER) * CF(EXPERT)$$

$$0,4 * 0,6 = 0,24$$

$$0,6 * 0,6 = 0,36$$

$$0,6 * 1 = 0,6$$

$$0,6 * 0,6 = 0,36$$

$$0,6 * 0,8 = 0,48$$

$$0,6 * 0,6 = 0,36$$

$$0,4 * 1 = 0,4$$

$$0,4 * 0,8 = 0,32$$

Then the symptoms are combined according to the rule with the following combination formula:

$$CF_{Combine} CF(H,E)_{1,2} = CF(H,E)_1 + CF(H,E)_2 * (1 - CF(H,E)_1)$$

$$0,24 + 0,36 * (1 - 0,24) = 0,5136$$

$$0,5136 + 0,36 * (1 - 0,5136) = 0,688704$$

$$0,688704 + 0,36 * (1 - 0,688704) = 0,80077056$$

$$\text{Average: } CF(H,E) * 100$$

$$0,800 * 100 = 80\%$$

Based on the above calculations, it is obtained that 80% of students experience low addiction

C. System Design

System design can be interpreted as a depiction stage in planning and making system flow. In this expert system, the system operation process is modeled using the Unified Modeling Language (UML) diagram.

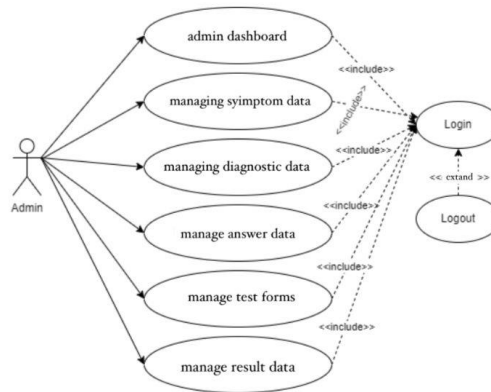


Figure 1. Use Case Diagram

D. System Implementation

At this stage, the researcher discusses the research results of the "expert system to diagnose the level of online game addiction in malikussaleh university students". The implementation will display the results of the system screenshots. Here's a view of the system:

1. Login page. Before starting data processing, it is important for the admin to log in to the system by entering a username and password. This step is essential to prevent unauthorized access to data that can only be processed by admins.

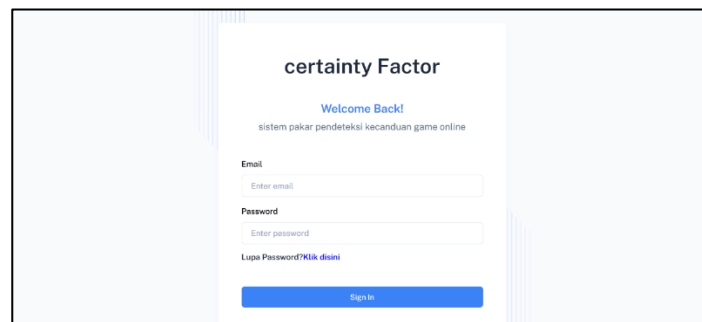


Figure 2. Login Page Display

2. Forgot Password page . The forgot password interface of the expert system to diagnose the level of online game addiction in malikussaleh university students. there are three fields to fill in: one labeled "Email", "Password" and the other "Confirm Password". At the bottom of this interface, there is a button that says "Reset Password".

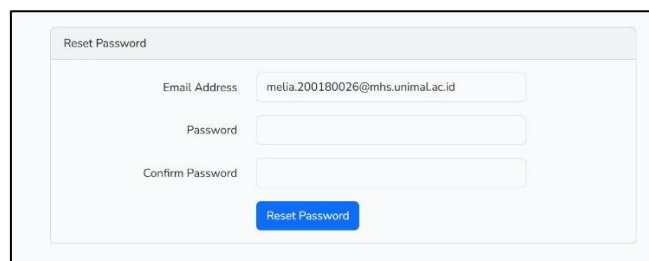


Figure 3. Forgot Password Page Display

- Home page . There are four main rectangular elements in different colors: blue, orange, green, and purple. Each rectangle contains a number and a label underneath. The blue rectangle has a number 5 with the label "Answer," orange has a number 3 with "Diagnosis," green shows a number 5 with "Answer," and purple has a number 4 with "Diagnosis Results." These elements represent different parts or functions of the app such as diagnoses made, answers given, and diagnosis results.

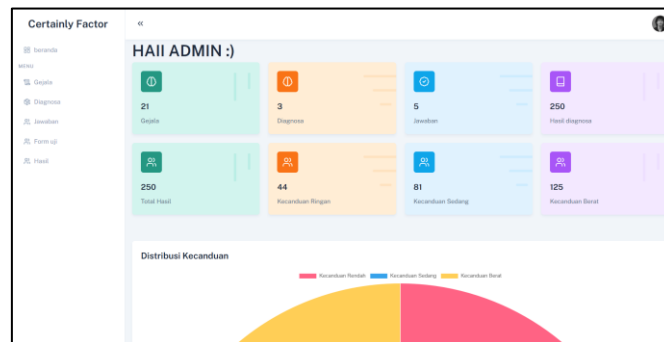


Figure 4. Home Page Display

- The Symptoms page . There are navigation tabs labeled "Dashboard," "Symptoms," "Diagnoses," "Answers," and "Test Form." The main area of the interface shows a table titled "Symptoms" with columns for number, code, Name, cf, and Action. Each row represents a different module, and with corresponding cf and action buttons. On the right side, there is a search bar above the table. The bottom right corner has a pagination control indicating that the user is on page 1 of several pages.

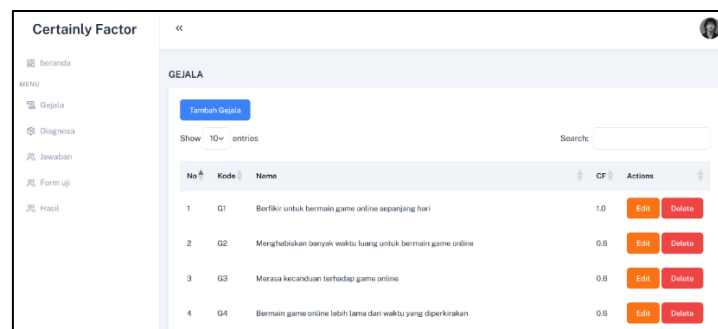


Figure 5. Symptom Page Display

- Diagnosis page . The main area shows a table under the heading "Symptom List" with columns labeled No, Code, Name, and Action. There are three entries in this table, each with an orange button labeled "Edit" and a red button labeled "Delete". At the bottom, there is a pagination showing that there are 1-3 entries out of a total of 3 entries.

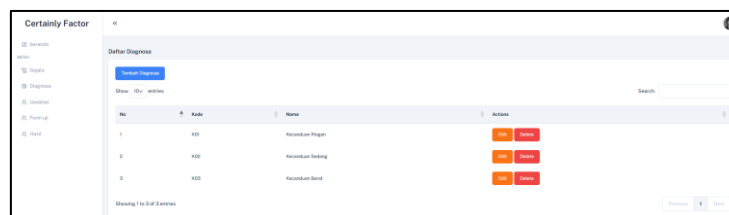


Figure 6. Diagnosis Page Display

- The Answers page . is the main area showing a table under the heading "List of Answers" with columns labeled No, Answer, Weight and Action. There are three entries in this table, each with an orange button labeled "Edit" and a red button labeled "Delete". At the bottom, there is a pagination showing that there are 1-5 entries out of a total of 5 entries.

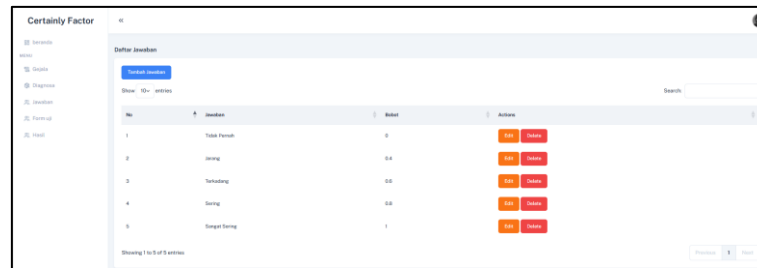


Figure 7. Answer Page Display

- Test Form page . a form that is part of the system, for diagnostics or decision-making support, given the context of the fields. This form contains several input fields with labels, such as "Name," and "symptom".

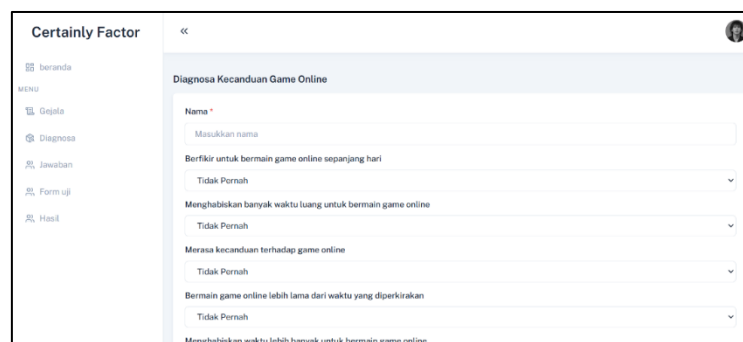


Figure 8. Display of Test Form Page

- Results Page . The result page contains a table with the title "Diagnosis Result Data" which has columns such as No, Name, CF (Certainty Factor) Result, Percentage, Addiction Type, and Action. There are three rows of data with different values for each column. The 'Action' column includes buttons labeled 'Detail' and 'Delete' that are colored orange and red respectively. At the bottom of the table, there is a pagination control indicating that this is page 1 of 1, showing 1 to 4 entries out of a total of 4 entries. Above the table, on the right side, is a search bar.

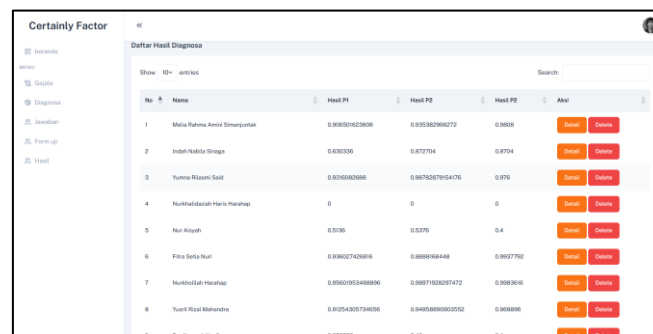


Figure 9. Result Page Display

Conclusions

From the results of designing an expert system to diagnose the level of online game addiction in malikussaleh university students, several conclusions can be drawn, among others:

- An expert system to detect the level of addiction to playing online games on malikussaleh university students results in 250 samples of malikussaleh university student data obtained as many as 44 people or 17.6% of the sample experiencing mild addiction, as well as 81 people or 32.4% of the sample experiencing moderate addiction, and 125 people or 50% of the sample experiencing severe addiction to online games.
- In this study, an expert system to diagnose the level of online game addiction in Malikussaleh University students was successfully designed using a certainty factor (CF) based approach. This system is designed through several stages, namely needs analysis, design, and modeling of diagnostic rules based on symptoms of online game addiction commonly experienced by students.
- The expert system built in this research was successfully implemented with web-based technology. The

development was carried out using a specific platform that supports accessibility and user-friendly interface, so that it is easy to use by users. The development process includes creating a user interface, integrating with the database, and applying certainty factor logic to analyze the level of online game addiction. The system has been tested using 250 student data samples and shows adequate performance in providing diagnostic results.

4. The certainty factor method was successfully applied in an expert system to measure the confidence level in diagnosing online game addiction based on the symptoms entered by the user. Each symptom is assigned a certain weight value according to the severity observed, and the system automatically calculates the CF value to determine the level of online game addiction from low, medium, to high. This method proves to be effective in handling the uncertainty of the inputted data and provides more accurate results in diagnosis than conventional methods.

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