DESIGN OF EXPERT SYSTEM FOR IDENTIFY OF ANXIETY DISORDERS USING FORWARD CHAINING

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Abstract
Anxiety is an excessive anxiety disorder in psychology. People are basically not aware that they may have symptoms of this anxiety disorder in each of them. And if not treated as soon as possible can interfere with a person's psychological condition. It may seem trivial but this disorder can reduce performance so that it has an impact on a person's life. To overcome this problem, we need an expert system that can identify anxiety disorders using a forward chaining algorithm. This system is designed using UML (Unified Modelling Language). The purpose of this UML modeling is to describe the user's needs for the system and what things can be done by the system, so that with this UML modeling the entire system picture can be seen. The UML modeling for the expert system for early identification of anxiety disorders with the forward chaining algorithm is expected to be a tool that can assist the system creation process, where people can check whether they suffer from anxiety disorders or not to consult a psychologist.

Keywords: UML, Expert System, Anxiety Disorders, Forward Chaining Algorithm

INTRODUCTION
Anxiety is one of the disorders in psychology. Anxiety or anxiety is a condition of urgency that comes from outside the body, not from within. When this anxiety comes, it will make the person to do something (Calvin S. Hall & Gardner Lindzey 2009). This anxiety is a symptom in the form of surprise at something that terrorizes humans accompanied by physiological changes (Asma 2014).

This anxiety is an excessive anxiety disorder that people sometimes don't realize about themselves. If not treated immediately, this disorder can interfere with a person's psychological condition and mobility. It may seem trivial but this disorder can reduce performance so that it has an impact on a person's life. Therefore we need an expert system identification of anxiety disorders to overcome this problem. Expert systems can solve a particular problem by imitating the way the experts work (Okmayura and Effendi 2019). With this expert system, the general public can consult with the system such as consulting a psychologist (Kangeraldo, Sari, and Zul 2018). This expert system can also be used as a companion tool from experts (Kurniadi, Mulyani, and Rahayu 2021) and not to substitute the expert (Istiyawan and Wibisono 2020). Several studies have proven that expert systems with forward chaining algorithms
are capable of diagnosing lung disease (Anon 2016), stomach disease (Indah and Dewi 2019) and rubber plant disease (Rofi,qoh, Kurniadi, and Riansyah 2020).

This system is designed using Unified Modeling Language (UML) diagram modeling. UML is an industry standard language for designing and visualizing and documenting system models (Pohan 2019). The purpose of this UML modeling is to be able to support automated analysis (Subhiyakto and Utomo 2017). In addition, this modeling aims to describe user needs for the system and what things can be done by the system, so that with UML modeling, the entire system picture can be seen. The UML modeling for the expert system for early identification of anxiety disorders is expected to be a tool that can assist the process of making the system, where people can check whether they suffer from anxiety disorders or not to consult a psychologist.

This UML modeling can describe an information system for monitoring the sale of goods (Ade Hendini 2016), lecturer remuneration information system design (Suendri 2018), sales information system design in building stores (Yunita 2018). In addition, modeling with UML has also succeeded in designing an employee performance reporting system (Putra 2018), printing product sales information system design (Aji et al. 2018). In the health sector, UML modeling has also been successful for the design of queuing software in health clinics (Syazili and Chandra 2018). In the world of education, UML modeling has also succeeded in designing a web-based school information system (Irawan, Susanti, and Triyanto 2016).

RESEARCH METHODS

The research methodology is a systematic step carried out during this research. For more details, the framework of this research can be seen in Table 1 below.

Table 1. Research Method

| Stages          | Action                          | Method / Tools                                                                 |
|-----------------|---------------------------------|-------------------------------------------------------------------------------|
| Planning        | Literature Study                | Literature Study                                                             |
|                 | Field Study                     | Book                                                                          |
|                 |                                 | Journal                                                                       |
|                 | Identify Problems               | Field Study                                                                   |
|                 | Find Research Objectives        | Interview                                                                     |
|                 |                                 | Observation                                                                   |
| Analysis and    | Analysis                        | Method:                                                                       |
| Design          |                                 | Forward Chaining Algorithm                                                   |
|                 |                                 | Tools:                                                                        |
|                 |                                 | UML                                                                           |
|                 |                                 | Use Case Diagram                                                             |
|                 |                                 | Activity Diagram                                                             |
|                 |                                 | Entity Relationship Diagram                                                  |
|                 |                                 | Design of Main Menu                                                           |
|                 | Design                          | Show actors interacting with the system using use case diagrams               |
|                 |                                 | Describing processes with activity diagrams                                 |
|                 |                                 | Describe the Interface                                                       |
|                 |                                 | Designing relationships between entities with ERD                            |

RESULTS AND DISCUSSION

Planning

a. Literature Study

Literature study is the initial stage of this research method. This method is carried out to obtain additional literature data from reference books regarding the problems raised in this study, namely the definition of expert systems, the use of the forward chaining method and various kinds of anxiety disorders and their symptoms sourced from books, journals, scientific papers.
b. Field Study
In this research, the authors conducted direct interviews with two psychologists, namely Ummil Khairiyah, M.Psi, Psychologist and Sri Wahyuningsih, S.Psi, MA, M.Psi. From interviews obtained information related to anxiety disorders, symptoms and solutions. Anxiety disorders are divided into several parts, there are (Association 2004):

a. Panic attacks, this attacks start suddenly and cause worry, fear or terror. A person may have a feeling of impending doom, shortness of breath and chest pain
b. Agoraphobia, anxiety about trying to avoid, places or situations where a person might feel trapped or embarrassed to leave if they start having a panic attack.
c. Specific phobia, this phobia is characterized by significant anxiety when a person is exposed to a particular object or situation and a desire to avoid it
d. Social phobia, this phobia is characterized by significant anxiety triggered by exposure to some type of social or performance situation and a desire to avoid that fear.
e. Obsessive compulsive disorder, characterized by persistent, recurring anxiety, thought images or impulses or an irresistible desire (obsession) to perform an irrational act
f. Post traumatic stress disorder, this disorder is characterized by the feeling that a person is experiencing a very traumatic event again
g. Acute stress disorder, characterized by symptoms similar to those of post-traumatic stress disorder that occur immediately after a highly traumatic event
h. Generalized anxiety disorder, this disorder is characterized by excessive anxiety and worry about things big or small that persists for at least six months

Analysis
a. Analysis of Existing Systems
After making observations in the field, it turns out that many people in general do not realize that they can suffer from this anxiety disorder. Moreover, the costs required for consultation with a psychologist are also quite expensive. Therefore we need an application that can identify anxiety disorders early that can be used by ordinary people easily, namely with an expert system for early identification of anxiety disorders using a forward chaining algorithm. This algorithm works from cover to cover, meaning that the way it works is sequential, starting from questions from initial symptoms to more specific questions, resulting in conclusions about what disorders the user is suffering from.

b. Analysis of Forward Chaining Algorithm
This forward chaining algorithm is a search technique that matches the symptoms experienced by the user with anxiety disorders based on existing rules so that later what disturbances the user experiences. The matching process stops when no more rules can be executed. After the anxiety disorder is concluded, the expert system will recommend solutions or therapies that the user can take to overcome the disorder. For more details, the flowchart of the forward chaining algorithm for the identification of anxiety disorders can be seen in Figure 1 below.
The following is a table for designing forward chaining algorithm rules for an anxiety disorder identification expert system.

| No. | Rules |
|-----|-------|
| 1.  | If Excessive anxiety is True And Heart pounding is True And Feeling worried and uncomfortable is True And Feeling nauseous is True And Feeling pain in the chest is True And Feeling hot and cold is True And Afraid to die is True And Experiencing shortness of breath is True And Panic or catastrophe will come is True Then Panic Attack |
| 2.  | If Excessive anxiety is True And Heart pounding is True And Difficult to concentrate is True And Feeling worried and uncomfortable is True And Excessive sweating is True And Fear of losing control is True And Experiencing anxiety when in a difficult situation is True And Fear of being in a crowd is True And Fear of being outdoors or traveling (in a bus, train or car) is True And Often bring friends who will be with you when you feel panic is True Then Agoraphobia Disorder |
| 3.  | If Kecemasan yang berlebihan is True And Difficult to concentrate is True And Feeling worried and uncomfortable is True And Excessive sweating is True And Fear of losing control is True And Have you ever admitted that your fear is excessive and unwarranted is True And At the age of under 18 years of experience at least 6 months of fear is True Then Social Phobia |
| 4.  | If Kecemasan yang berlebihan is True And Difficult to concentrate is True And Feeling worried and uncomfortable is True And Excessive sweating is True And Fear of losing control is True And Have you ever admitted that your fear is excessive and unwarranted is True And At the age of under 18 years of experience at least 6 months of fear is True And Feeling constant fear of social situations leading to humiliating acts is True And Experiencing stress or distraction in normal, routine situations is True Then Social Phobia |
| 5.  | If Kecemasan yang berlebihan is True And Difficult to concentrate is True And Feeling worried and uncomfortable is True And Feeling worried and uncomfortable is True And Recurrent and persistent thoughts, impulses, or urges that cause anxiety is True And Repetitive mental behaviors and actions that a person performs to relieve tension is True And Terus Constantly washing hands to remove dirt and germs is True And Doing things out of the ordinary is True And Constant worry that something bad will happen to family members is True And Fear of being dirty and exposed to germs or infections is True Then Social Phobia |
| No. | Rules |
|-----|-------|
| And | Spouse's fear of getting into danger while driving a vehicle **is True** |
| Then | Obsessive compulsive disorder |

6. **If** Kecemasan yang berlebihan **is True**
   And Difficult to concentrate **is True**
   And Feeling worried and uncomfortable **is True**
   And Feeling worried and uncomfortable **is True**
   And Responding with fear, helplessness **is True**
   And Dreaming about recurring scary events **is True**
   And Trying to avoid thoughts, feelings and conversations associated with the traumatic event **is True**
   And Loss of interest in participating in various activities **is True**
   And Perasaan away or isolated from others **is True**
   And Feeling symptoms for more than one month **is True**
   And Excessive vigilance **is True**
   And Surprisingly exaggerated response **is True**

**Then** Post Traumatic Disorder

7  **If** Kecemasan yang berlebihan **is True**
   And Difficult to concentrate **is True**
   And Feeling worried and uncomfortable **is True**
   And Feeling worried and uncomfortable **is True**
   And Feeling not in reality **is True**
   And The feeling of feeling disconnected from oneself **is True**
   And Responds with fear, helplessness **is True**
   And Experiencing and witnessing events involving death threats **is True**
   And Feelings of disconnection, numbness and lack of emotional response **is True**
   And Decreased feeling of awareness of the surrounding environment **is True**
   And Re-experiencing traumatic events through images, thoughts, dreams so that they feel strong stress when shown again with things that remind them of the event **is True**

**Then** General Anxiety Disorder

8. **If** Kecemasan yang berlebihan **is True**
   And Difficult to concentrate **is True**
   And Feeling worried and uncomfortable **is True**
   And Feeling worried and uncomfortable **is True**
   And Choking feeling **is True**
   And Feeling nauseous **is True**
   And Shaking **is True**
   And Feel dizzy **is True**
   And Other related worries and anxieties cause significant stress **is True**
   And Have difficulty controlling feelings of anxiety **is True**
   And Easily startled or startled **is True**
   And Having trouble sleeping **is True**
   And Easily angry **is True**
   And Experiencing tense muscles **is True**
   And Difficult to breathe normally **is True**

**Then** Acute Stress Disorder

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**Design**

At this stage the researchers designed an expert system for identifying anxiety disorders using UML, starting from Use Case Diagrams, Activity Diagrams, Entity Relationship Diagrams and menu designs.

**a. Use Case Diagram**

Use Case Diagrams illustrate how users or actors can interact with the system (Okmayura et al. 2019). In the design of this system there are 3 actors who interact with the system, namely admin, psychologist and user. Admin can enter data in the form of symptoms, disorders, questions, solutions, probability values. Then the user can conduct consultations and psychologists can see the results of the medical records of users who have consulted on the system. More details can be seen in Figure 2 below.
b. Activity Diagram

Activity diagrams can be used to describe workflows or step-by-step activities in a system. Activity Diagram memiliki atribut dengan bentuk tertentu yang dihubungkan dengan tanda panah yang mengarahkan urutan aktivitas yang terjadi dari permulaan hingga akhir (Rizky Muhammad; Irma Kartika Wairooy, S.Kom. 2019).

This activity diagram shows how the overall control flow looks like. In this system, the user will enter the main page then the user must login. If the login fails, the user returns to the main page and if the user successfully logs in, the user will enter the identification page. Furthermore, the user identifies the anxiety disorder on himself independently. When finished, the identification result will appear. For more details, the activity diagram of this anxiety disorder identification system can be seen in Figure 3 below.

![Activity Diagram]

Figure 3. Activity Diagram

c. Main Menu Design

The design of the menu structure aims to present the arrangement of the menus in the system. The design of the expert system menu structure for the identification of anxiety disorders is shown in Figure 4 as follows.

![Main Menu Diagram]

Figure 4. Design of Main Menu
d. **Entity Relationship Diagram (ERD)**

Entity Relationship Diagram is a model diagram that aims to explain the relationship between data in a database that has a relationship between relationships (Ibeng 2018). In this expert system ERD there are several entities. For more details can be seen in Figure 5 below.

![Entity Relationship Diagram](image)

**Figure 5. Entity Relationship Diagram**

Based on Figure 5, the ERD which is designed in the expert system for early identification of anxiety disorders has 5 entities, namely users, medical records, solutions, disorders and symptoms. Each entity has its own attributes. Between one entity and other entities are interconnected to form a single entity.

**CONCLUSIONS AND SUGGESTIONS**

**Conclusion**

Based on the research that has been done, modeling with UML can be used to design an expert system for identifying anxiety disorders with forward chaining algorithm. UML modeling with use case diagrams, activity diagrams, data flow diagrams and entity relationship diagrams is very easy for users in designing expert systems. With this UML modeling, the system to be built will be closer to the actual user needs because the user in this case is a psychologist who plays a direct role and is involved in analyzing system requirements.

**Suggestion**

This research is expected to help create an expert system modeling for the identification of anxiety disorders, so that it can be used for the wider community. Then it is also hoped that modeling through the Unified Modeling Language can be developed also to design other information systems.

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