Expert System for Monitoring Stress Levels in College Students

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***Abstract*—Ineffective stress management is a serious problem that many college students face. When stress reaches chronic levels, it can be harmful to a college student's health causing problems such as: physiological and mental health disorders. The purpose of this project is to design and implement a rule based expert system that helps students monitor their stress levels during their college years. The system gathers information from the student via a series of questions and then suggest stress reducing techniques directly to the student.**

I. Introduction

Stress is a natural reaction of the human body to a challenge. When stress is experienced in moderate levels, it can be beneficial for someone's health because it can sharpen the mind and reflexes. On the other hand, when stress is experienced in high levels over a sustained period of time and not managed appropriately, often known as chronic acute stress, it can be very harmful to a person's health [1]. It can lead to very serious physiological and mental health problems. Physiological health hazards caused by stress may include: chest pains, headaches and fatigue. Among the mental health conditions caused by stress are: anxiety, depression and even can lead a person to commit suicide. According to the American College Health Association, more than 40.8 percent of college students experience more than average stress within the last 12 months. Moreover, 30.7 percent of the students surveyed indicated that stress is the most influential factor that negatively affects their academic performance. [2] Common stressors in college life may include: Greater academic demands, financial responsibilities or being away from home, often for the first time. [3] Nonetheless, many college students not only experience a decline in their academic performance, but, their mental health suffers as well due to the high amounts stress experienced during their college years.

More than 25 percent of college students have been diagnosed or treated by a professional for a mental health condition within the past year. [4] In addition, almost 73 percent of college students living with a mental health condition experienced a mental health crisis on campus. Surprisingly, 34.2 percent reported that they did not know about their crisis. Most college students do not know how to balance academic demands with a healthy lifestyle [5]. That is, by implementing healthy habits, time management techniques and effective study skills. Consequently, the urgent need of orienting college students about stress, the importance of its effective management and impact to their health surges.

This project is focused on creating a rule based expert system to assist college students in monitoring their daily stress levels. In order to achieve this goal, the system acquires data from the student by asking a series of questions, process the gathered data from the questions and give stress reducing recommendations directly to the student. These recommendations are verified and approved by a licensed mental health professional. Nevertheless, the system does not intend to replace the mental health professional, whereas, make the student aware of the importance of reducing stress and referring to a professional if needed. The system was programmed in the Java language, using the NetBeans IDE and the Rule library. [6]

The remaining parts of the paper are organized as follows. Section II presents the methodology used. Section III describes the expert system in detail. In Section IV, the results are presented and fully explained. The conclusions are discussed in section V. Lastly, Section IV presents the future work that is left to complete in the project.

II. Methodology

In this section, the designed methodology and the system functionalities are discussed.

The proposed system works as follows. First, the system gathers the data from the user. After gathering the data, the system will make the decisions using the knowledge provided by the expert. Finally, it will report the decisions that are product of the decision making process. Figure 1 provides a visual representation of the system's process description.

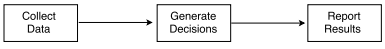

Fig. 1: System Process Description

In order to perform this process, the system is composed of three main components: the user interface, inference engine and knowledge base. Now, when the system starts execution, the user will see a questionnaire available in the computer screen, provided by the user interface. After the user answers the premises displayed, the collected data from the user interface is sent to the inference engine, which evaluates

the data using the rules available in the knowledge base administered by the domain expert. Therefore, the inference engine generates the results, recommendations and displays them in a separate screen. Figure 2 illustrates the system architecture which represents the complete system functionalities just described.

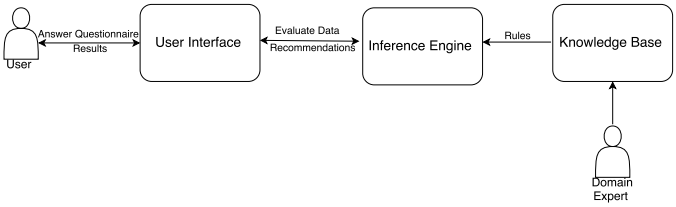

Fig. 2: System Architecture

The premises used are from a modified version for college students of the Holmes and Rahe Stress Inventory [7]. The following subsection explains more about the scale and how it is interpreted.

A. Holmes and Rahe Stress Inventory

In 1967, psychiatrists Thomas Holmes and Richard Rahe studied whether or not stress contributes to illness. They surveyed more than 5,000 patients and asked them to say whether they had experience any of a series of 43 life events in the previous two years.
Each event is assigned a specific Life Chaning Unit (LCU for short). These units represent "weights" of the stress in each of the events. The survey is answered in a yes or no fashion. Then, the weights are added up. The higher the score obtained, the risks of suffering any type of stress related illness increase dramatically. If the score is equal to 300 or greater, the score classifies the stress level as major stress. Furthermore, scores that fall under the major stress rage are interpreted as, 80 percent chance of health breakdown in the next 2 years, according to the Holmes-Rahe statistical prediction model. Now, if the score is less than 300 but greater than 150 points, the patient has 50 percent chance of health breakdown in the next 2 years. Lastly, if the score is below 150 points, this means that the patient has a relatively low amount of life change and a low susceptibility to stress-induced health breakdowns.

B. College Student Version

Just like the original version, in the college student version [8] each event is assigned an specific weight (LCU) and are added up. However, the college student version includes 31 events and these are tailored for the college student lifestyle. Another difference from the original inventory is that after the scores are added up, these are classified into five categories: Major, Serious, Moderate, Mild and low stress. Table 1 shows the score ranges and their corresponding category in the student stress scale.

TABLE I: Holmes and Rahe Student Stress Scale

Score Type	Classification
300 or more	Major Stress.
250-299	Serious Stress
200-249	Moderate Stress.
150-199	Mild Stress.
0-149	Very Little Stress

Now, using the categories provided by the college student stress scale, we designed an algorithm that correlates the stress score classifier with an assigned intensity to each premise, also assigned by us.

C. Data correlation

An event can be of: Very High, High, Medium and Low intensity. The correlation process consists of relating the score classification with the premise intensity. After the relationship is made, the resulting information of the relationship is examined. This information we call it, the vulnerability level. This level determines the student's emotional and mental health state caused by stressful situations. This correlation process is also known as "Vulnerability Level Assignment".

III. Expert System

This section discusses in detail the components of the system. Each of the components is explained in each of the following subsections.

A. User Interface

The user interface displays on screen a total of 31 premises along with a submit button. Figure 3 depicts the user interface of the proposed system.

B. Inference Engine

The inference engine is the system component responsible for making a successful decision. In order to accomplish this, the inference engine utilizes the algorithm known as forward chaining implemented in the Rule library [6]. Forward chaining is an approach used by an expert system to simulate the decision making process by the domain expert. The inference engine follows a sequence (chain) of conditions and derivations to deduce the outcome [9], [10]. Figure 4 illustrates the decision tree formed that the system uses to generate the stress reducing recommendations and provide them to the student.

However, before starting the decision making process, the system calculates the score obtained by the student in the survey. Then, using the metrics provided by the College Student Stress Scale by Holmes and Rahe, the score is classified in the corresponding of the following five categories: Major, Serious, Moderate, Mild and Little stress. When the system starts the decision generation process, first, the system verifies the score and identifies which of the categories it belongs to. Then, it evaluates the premises and answers of the student in the questionnaire in order to identify the level of vulnerability of the student due to the corresponding stress level. Finally, the system determines if the student needs to visit a mental health professional.

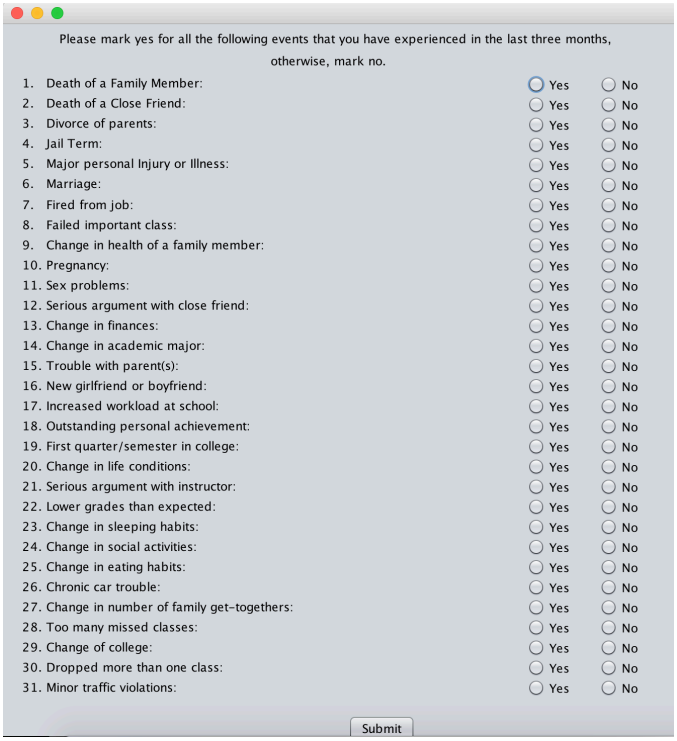

Fig. 3: User Interface Screen

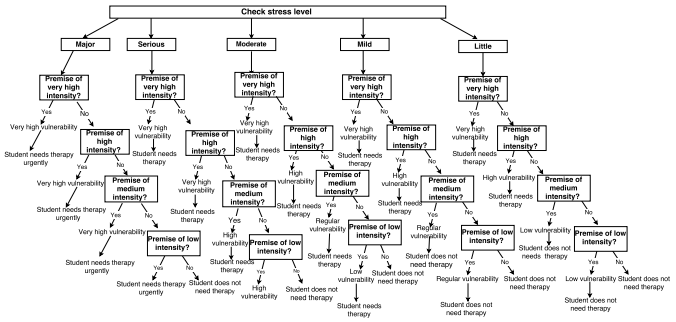

Fig. 4: Decision Tree

C. Knowledge Base

The knowledge base is the system component that contains all the rules and expertise provided from the domain expert. The rules are used by the Inference engine using the forward chaining algorithm [9], [11]. All of these rules are based on the College Student Stress scale made by Holmes and Rahe and the designed algorithm. [8]

IV. Results and Discussion

After the score is classified, the system can determine if the student may need to visit a mental health professional according to the knowledge provided by the expert. For this, an algorithm was designed that correlates the score obtained with the type of intensity of the premises answered by the student.

In order for the system to suggest to the student that he/she needs therapy or not, one of these cases must occur: The student's score falls into the categories of Major, Serious and Moderate, or, the student score can be any of the five types but the student must have answered yes to a premise of very high and high intensity. That is, If the student obtains a score categorized as mild or low stress, but, answered yes to the premise "Death of a Family Member", the system would still determine the vulnerability level as High Vulnerability. Table 2 depicts the interpretation of the possible scenarios.

According to the vulnerability level, the urgency of proper mental health care can be resolved. The vulnerability level is not only used by the system to determine if the student needs therapy or not and the urgency of it, it is also useful information for the therapist to provide an even more personalized treatment to the student's needs. Figure 5 shows the report screen that appears in the user interface.

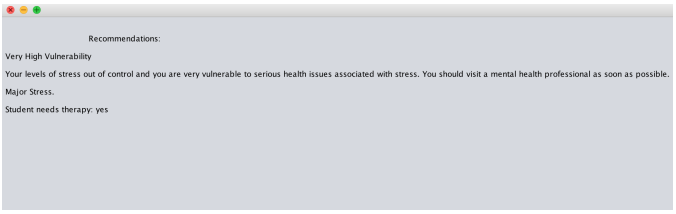

Fig. 5: Report Result Example Screen

TABLE II: Data Interpretation

Classification	Premise Intensity	Vulnerability	Needs Therapy
Major Stress	Very High	Very High	Yes
Major Stress	Medium	Very High	Yes
Major Stress	Low	Very High	Yes
Serious Stress	Very High	Very High	Yes
Serious Stress	High	High	Yes
Serious Stress	Medium	High	Yes
Serious Stress	Low	High	Yes
Moderate Stress	Very High	Very High	Yes
Moderate Stress	High	Very High	Yes
Moderate Stress	Medium	Regular	Yes
Moderate Stress	Low	Regular	Yes
Mild Stress	Very High	Very High	Yes
Mild Stress	High	High	Yes
Mild Stress	Medium	Regular	No
Mild Stress	Medium	Regular	No
Very Little Stress	Very High	Very High	Yes
Very Little Stress	High	High	Yes
Very Little Stress	Medium	Regular	No
Very Little Stress	Low	Low	No

V. Conclusions

The results produced can be used to identify the symptoms of chronic acute stress in college students and prevent them

from forming into serious health problems. Therefore, the proposed system does not intend to substitute the mental health expert, whereas, assist them into treating the effects of chronic stress. On the other hand, this system also aids the student because it can make him/she aware of the daily stressful events they encounter and how to properly cope with them.

VI. Future Work

In the future, we would like to export the application from the desktop to the Android smartphone platform. Another thing we want to do is, add more stress reducing techniques.

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