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# Survey: Stress Management Using Artificial Intelligence

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**Abstract:** These days the term stress is considered to be one of the major factors leading to various health problems. The diagnosis largely depends on the physician and based on his interpretations and measurements. But it is not possible for the user to get the diagnosis done on a regular basis due to the hectic schedule. This problem can be dealt in an easy way when the human intervention gets replaced by an artificial intelligent system that will ensure a more better and a consistent diagnosis. Our system is proposed based on physiological signals. Parameters like heart rate variability, blood pressure and body temperature provide the information about the user's state of mind. This system will increase the accuracy level in the diagnosis. The response from the sensors reflects the reaction of individuals and their body to stressful events. Some individuals may react in a different manner to stressful events depending on their body conditions. Based on the proposed stress factors, the user's stress levels will be assessed on a regular basis and will be notified with respective safety measures. There can be some uncertainties and complexities that exist in the system which should be dealt with while defining stress. For this, the system makes use of fuzzy theory that will help make the stress outputs more optimum and precise.

**Keywords:** Stress, Heart Rate Variability, Physiological signals, Fuzzy logic.

## I. INTRODUCTION

Stress is a term that is recognized to be the only cause due to which a person suffers from several physiological disorders. It has a major impact on our body resistance which unknowingly leads to severe problems. Despite of its impact on our day to day life, it is still infeasible for a physician to monitor the stress levels and make the user aware about the same throughout the day. Thus, a system that would assess the user's stress levels on regular intervals would enable the user to keep a track of this data and take the necessary precautions.

A number of physiological signals like heart rate variability(HRV), blood pressure and body temperature have been identified that would assist the system to obtain the stress response of an individual. The system aims at replacing the human intervention required to assess the stress of an individual by an algorithm that would assist the application to analyze the stress response.

The system would be treated as an android application that would take the algorithm as an input which would assist the system to obtain the values for the proposed physiological signals. These inputs cannot be precisely stated as they vary on a frequent basis. Fuzzy logic is a theory that has proved to be a powerful tool to deal with imprecision, vagueness and uncertainties arising from the measurements taken. We have integrated the concept of fuzzy theory in our system to deal with the stress inputs and to classify according to the ranges.

## II. BACKGROUND

The three proposed parameters heart rate variability, blood pressure and body temperature have an equal impact on stress.

### 1. Stress and heart rate variability

The nervous system is the central part that controls the body reactions under any stable conditions. This system has two branches which help to keep a track of the fluctuations in the heart beat. So by analyzing the fluctuations in the beat-to-beat periods of the heart beat, the system can identify the contribution from each of the two branches. This mechanism is termed as heart rate variability (HRV).

### 2. Stress and blood pressure

Blood pressure has a very high impact on stress. It is measured based on the pressure exerted by the blood on the blood vessels. Blood pressure and heart rate are closely inter-related. During each heart beat the pressure varies between a maximum and a minimum value which is termed as systolic(high) and diastolic(low) pressure. It depends on the pumping action of the heart. There are some differences observed in the mean blood pressure values which depend on the rate of blood flow through the vessels. The blood flow is dependent on the resistance which is obtained by the physiological condition of the body (stress level). The mean blood pressure drops down when the blood circulation is low. During high stress level, the heart has to work harder for the pumping of blood. The normal blood pressure reading is within the range of 100-140mmHg (systolic) and 60-90mmHg (diastolic).

### 3. Stress and body temperature

Body temperature is the preliminary sensor signal that will help the system to realize individual stress with respect to changes in the temperature values. It is dependent upon the blood flow. Changes in the body temperature are observed for analysis. Temperature change can be easily

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interpreted, warm body indicates relaxation and cold body indicates tension or stress. The amount of change in the body temperature indicates the stress level of an individual.

## III. IMPLEMENTATION

Our system would be designed as an android application that takes the algorithm as input to obtain the stress responses from users. The stress responses would be measured based on a scanning mechanism. The mechanism works by placing the index finger on the back camera of the phone, and when the flash light switches on depending on the blood flow at that moment the heart beat intervals can be measured. This beat-to-beat interval would assist the system to calculate the blood pressure values. The temperature values can be measured based on the temperature of the hand. The finger scanning mechanism proves to be an useful aid for analyzing and quantifying the stress related responses.

Due to frequent fluctuations in the values of the sensor signals, vagueness and imprecision exists in the system. The algorithm will make use of fuzzy logic to assist these inputs with respect to precise and crisp values. Fuzzy Inference System will take the crisp inputs and will generate the membership functions via fuzzification. This will help the system to generate more precise outputs for the stress responses.

To obtain the appropriate data the ranges have to be specified.

### (1) Heart Rate Variability

| **Age** | **18-35** | **36-55** | **55-65** | **65+** |
|---|---|---|---|---|
| Athlete | 49-55 | 50-56 | 51-56 | 50-55 |
| Excellent | 56-61 | 57-62 | 57-61 | 56-61 |
| Good | 62-65 | 63-66 | 62-67 | 62-65 |
| Above average | 66-69 | 67-70 | 68-71 | 66-69 |
| Average | 70-73 | 71-75 | 72-75 | 70-73 |
| Below average | 74-81 | 76-82 | 76-81 | 74-79 |
| poor | 82+ | 83+ | 82+ | 80+ |

### (2) Blood Pressure

| **Blood Pressure** | **Systolic(mmHg)** | **Diastolic(mmHg)** |
|---|---|---|
| Very low | 50-90 | 35-65 |
| Low | 80-110 | 55-75 |
| Normal | 110-130 | 75-85 |
| Moderate | 125-145 | 80-90 |
| High | 140-180 | 88-110 |
| Very high | 170-210 | 105-135 |

### (3) Body Temperature

| **Temp (F)** | **Temp (C)** | **Stress level** |
|---|---|---|
| Below 79 (min 60) | Below 26 | Highly stressed |
| 79-84 | 26-29 | Slightly stressed |
| 84-90 | 29-32 | Mildly calm |
| 90-95 | 32-35 | Slightly relaxed |
| Above 95 (min 99) | Above 35 | Deeply relaxed |

## IV. CASE BASED REASONING

The stress management system is proposed based on physiological sensor signals of an individual. This system is a learning and adaptive system and will use its previous knowledge to analyze the individual stress response and classify into respective categories. This system will try analyzing the stress factors based on previous knowledge which will be stored in the knowledge base of the system. Every time a new sensor signal gets detected, the knowledge base will get auto-updated. Whenever a new user interacts with the system, a new stress profile will be created which will consist of all his medical details. This profile will be analyzed by the algorithm with respect to the knowledge base and current stress responses.

Case-based Reasoning is a subfield of Artificial intelligence. It emphasizes on how new techniques and experiences help the system to overcome the difficulties which were faced when dealing with previous situations. The preliminary step while developing a CBR system is hot to formulate a case. A case is a piece of knowledge that represents experience and plays a vital role in the reasoning process. So a case in general is an instance or a part of situation experienced in the past. These cases have unique features to describe the problem and can be presented in different ways. To provide a solution to a new case these cases can be represented using a problem and a solution structure. For the evaluation of a current case, the previous one can contain its outcome.

The CBR cycle is consists of four stages: retrieve, reuse, revise and retain.

## V. RESULTS

The system takes the measurement values for the physiological signals and the algorithm analyzes the inputs for computing the stress levels. The individual stress levels are categorized as highly stressed, slightly stressed, calm, slightly relaxed and deeply relaxed.

## VI. CONCLUSION

The proposed system has a strategy that will assist in computing the stress levels of an individual accurately. This model is better than the existing models because it uses extra parameters for evaluating the stress levels.

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