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Methods for Stress Assessment : A Review

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ABSTRACT

This review of the literature gives information about stress and its adverse effects on physical and mental health of an individual. Stress is ever-present universal feature of life. It causes many health problems like heart diseases, digestion problem, sleep problem and depression. Psychological scale like, Effort-Reward imbalance scale (ERI), Depression, Anxiety Stress Scale (DASS), Occupational Stress Index (OSI), Perceived Stress Sale (PSS) are used to infer stress in terms of behavioral change. Various physiological parameters that can be used to monitor stress are Heart Rate (HR), Galvanic Skin Response (GSR) and Electroencephalography (EEG). However, HR and GSR showed the 99.5% of stress detection accuracy. Moreover methods have also been indentified for the prevention of stress at workplace.

Keywords : Stress, Physiological Parameters, Heart Rate, Blood Pressure, Psychological Scale, GSR, HR, EEG, DASS, OSI, PSS, ERI, APA.

I. INTRODUCTION

American Psychological Association (APA), defined stress as "The non-specific reaction from the human body in order to any kind of requirement positioned on it" [1]. Stress response is considered as when there is the increasing activity in the sympathetic part of the autonomic nervous system. Stress is a wide spread phenomenon which has been observed to raise undesirable health and reduces performance. Stress causes many health problems like heart diseases, digestion problem, sleep problem, depression etc [2]. Whenever, physiological signals changes under stress then there is variation in the efficiency of delivering energy (oxygen and glucose) to vital organs. The physiological signals, which increased efficiency, are: Heart Rate (HR) and Blood Pressure (BP), EEG signals, Respiratory system: Respiration rate and depth, GSR. Negative stress reduces work performance of an individual. Stress can be categorize into three types: Acute stress, Episodic acute stress and Chronic stress. Acute stress is the starting stage of stress. It arises from the commands and requirements of a particular situation. It is short-term stress body can recover quickly. Episodic acute stress is observed in those people who suffer from acute stress from long time. It occurs from time to time. Chronic stress is long period of stress people get used to it. It is harmful to people's health. It comes when person never sees a way out from unpleasant problems [3].

Various symptoms are associated with stress mainly headache, high blood pressure, indigestion, fatigue, insomnia, shortness of breath, anxiety, irritability, anger, mood swing, hypersensitivity, depression, feeling of helplessness, hopelessness , loss of appetite, impatience, quickness to argue, increased smoking, poor job performance etc [4].

II. METHODS AND MATERIAL

1. Stress Measurement Methods

Stress can be measured and evaluated in terms of perceptual, behavioral and physical responses. Stress can be evaluated by psychological scale-based or physiological signals-based analysis.

1.1 Psychological Scale

Psychological scale is commonly used to infer stress in terms of behavioral changes. The self-administered questionnaire includes all the personal data of the individual and physiological parameters. A number of instruments available to measure stress.

Table 1, defined the various psychological scales that measured stress. "Effort-Reward Imbalance Scale (ERI)". In effort-reward model considered that the negative thoughts take place when effort made by an individual higher than the reward the individual get. It is consisting of 23 items [5]. "Depression, Anxiety Stress Scale (DASS)". It is consisting of 42 items. It used to measure depression, anxiety, stress among individual. DASS cannot measure suicidality [6]. "Occupational Stress Index (OSI)" measure stress that cause through the working condition of a worker. It is consisting of 46 items. It measures the following conditions under load, high demands, strictness, extrinsic time pressure, uncertainty [7]. "Perceived stress questionnaire" it targets stress due to perceive stresses. It measures the stressfulness of situations that cause stress [8].

Table 1: Psychological scale used to measure stress [5], [6], 7], [8].

Sr. No	Scale	Measure	No of items	Reliability rate	Authors
1	Effort-Reward imbalance scale (ERI)	Discrepancy of effort and reward, Psychological stressors	23	0.89	Siegrist (1996), Siegrist et al. (2004)
2	Depression ,Anxiety Stress Scale(DASS)	Depression(hopelessness, low self-esteem) ,anxiety(autonomic arousal, muscular-skeletal symptoms), stress (tension, negative Affects)	42 (21)	0.88	Fernando Gomez
3	Occupational Stress Index(OSI)	Under load, high demands, strictness, extrinsic time pressure,	46	0.935	Srivastava and Singh (1984)
4	Perceived Stress Sale (PSS)	Stressfulness of situations that cause stress, nonspecific perceived stress	10	0.82	Cohen et al. (1983)

1.2 Physiological measures of Stress

Stress affects physiological signals like pulse rate, blood rate, heart rate, ECG, Galvanic skin response, Skin temperature [9].

1.2.1 Heart rate variability(HRV)

HRV refers to the difference between consecutive heartbeats. HRV is determined and continuously modulated by complex interactions between the sympathetic and parasympathetic system in order to properly respond to the demands of our body. These changes in heart rhythm constitute the concept of heart rate variability (HRV)**.** It has been used as an indication of stress and mental effort in adults and is a useful indicator in the high-stress environment. HRV decreases during the period of high stress [10].

1.2.2 Respiration Rate

Respiration rate corresponds to the number of breathes takes per minute. The most common measures of respiration are Rate of respiration (Resp Rate) and depth of breath (RespAmp). Respiration rate is increases while Emotional arousal increases, during rest and relaxation respiration rate is decreases. Negative emotions cause irregularity in the respiration pattern. Respiration is closely linked to cardiac function; irregularity in breath can affect cardiac measures. The normal respiration rate for an adult at rest is 12 to 20 breaths per minute. [11].

1.2.3 Galvanic skin response (GSR)

Galvanic Skin Response (GSR), also known as Electrodermal activity (EDA), is a indicator of skin conductance. When an individual is aroused or excited, the skin resistance varies with the state of sweat glands (eccrine glands) in the skin. Sympathetic nervous system controlled the Sweat glands. The moisture levels in the skin fluctuates the mean value of skin conductance level and this change in conductance can indirectly relate to mental activity. GSR is nonintrusive easily capture physiological signal that used for evaluation of effective

state of user, mainly for stress and arousal level. EDA changes with respect to changes in stress levels [12].

1.2.4 Electroencephalography (EEG)

EEG is a method to detect the abnormalities related to the electric activity of brain. EEG signal recorded from the brain by placing the non-invasive electrode on the scalp. EEG signals recorded from different lobes i.e.

Prefrontal pole (FP), Central(c), Parietal (P), Occipital (O) and Temporal (T) lobes provided the good observational data of variability in mental state. It shows the good co-relation with the mental health [13].

In Table 2, Some previous works for stress detection based on multiple physiological signals are summarized. Various physiological signals like Heart Rate (HR), Galvanic Skin Response (GSR), Electrocardiograms (ECG), Blood pressure (BP), Skin Temperature (ST) were investigated by different researchers to evaluate the stress. Through HR and GSR signals showed higher accuracy rate 99.5% for stress assessment.

Table 2 : Relation between different physiological signals and their stress detection accuracy rate [10- 12], [14-17].

Sr. No	Authors	Physiological signal	Stimuli	No. of person	Accuracy
1	Healey at el(2004)	ECG,EMG,RR,GSR	Driving task	24	97%
2	Kulic and Croft(2005)	ECG,EMG,GSR	Fuzzy state	8	76%
3	Wagner et.al(2005)	GSR,EMG,RR.ECG	Audio task	1	79.5-96.6%
4	Sharawi et.al (2008)	ST,GSR	Driving task	35	60-78%
5	Guag yuan(2009)	ECG,EMG,GSR	Audio task	1	75-85%
6	Sierra(2011)	HR, GSR	Fuzzy logic	80 Female	99.5%

2. Steps for the Prevention of stress at workplace

The following steps can be used to prevent the stress at work station [18].

- Establish an apparent framework regarding responsibilities and task.
- Keep up to a good schedule in which individual are compatible with demands and requirements of the job.
- Clearly specify worker's responsibilities and job.
- Provide workers opportunities in order to take part in activities and decisions which affects their work.
- Legal guideline, global and national wide directives and sociable support.
- Enhancing employment organizing and stability.
- Reduction associated with work time and proper arrangement of working groups.
- Organizing place of work based on ergonomic office criteria.
- Working together within graphic displays models.
- Organize team discussion between supervisor, work associate and employees.
- Design formal online survey regarding collecting stressful work problems.
- Determine employee's awareness regarding work issues and stress.
- Analyze data to recognize stressful work conditions [18].

III. CONCLUSION

This review summarizes the literature on stress and various psychological scale-based, physiological signal-based approaches for the measurement of stress. Various psychological scale like Effort-Reward Imbalance Scale (ERI), Depression, Anxiety and Stress scale (DASS) and Occupational Stress Index (OSI) are used for stress assessment and physiological signals including: Heart rate, GSR, EEG and EMG were discussed. Among these physiological signals HR and GSR are the most

prominent signals which provided the precise and accurate information on the physiological situation of individual. Moreover this review provides the various stress prevention methods for workers to deal with workplace stress.

IV. REFERENCES

[1] Avey JB, Luthans F, Jensen SM. Psychological capital: A positive resource for combating employee stress and turnover. Human resource management. 2009 Sep 1;48(5):677-93.

[2] Melchior M, Caspi A, Milne BJ, Danese A, Poulton R, Moffitt TE. Work stress precipitates depression and anxiety in young, working women and men. Psychological medicine. 2007 Aug 1;37(08):1119-29.

[3] Rehman H. Occupational stress and a functional area of an organization. International Review of Business Research Papers. 2008 Sep;4(4):163-73.

[4] Sowa CJ, May KM, Niles SG. Occupational stress within the counseling profession: Implications for counselor training. Counselor Education and Supervision. 1994 Sep 1;34 (1):19-29.

[5] Siegrist J, Starke D, Chandola T, Godin I, Marmot M, Niedhammer I, Peter R. The measurement of effort–reward imbalance at work: European comparisons. Social science & medicine. 2004 Apr 30;58 (8):1483-99.

[6] Henry JD, Crawford JR. The short-form version of the Depression Anxiety Stress Scales (DASS-21): Construct validity and normative data in a large non-clinical sample. British Journal of Clinical Psychology. 2005 Jun 1;4 4 (2):227-39.

[7] Srivastava AK, Singh AP. Manual of the occupational stress index. Varanasi, UP: Manovaigyanik Parikcchan Sansthan. 1981.

[8] Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. Journal of health and social behavior. 1983 Dec 1:385-96.

[9] M. shiva kumar." A studyon occupational strss among IT professionals,Chennai: International journal of enterprise innovation management studies. 2011 dec 1:453-92.

[10] de Santos Sierra A, Ávila CS, Casanova JG, Pozo GB. A stress-detection system based on physiological signals and fuzzy logic. Industrial Electronics, IEEE Transactions on. 2011 Oct;58(10):4857-65.

[11] Wagner J, Kim J, André E. From physiological signals to emotions: Implementing and comparing selected methods for feature extraction and classification. InMultimedia and Expo, 2005. ICME 2005. IEEE International Conference on 2005 Jul 6 (pp. 940-943). IEEE.

[12] Healey JA, Picard RW. Detecting stress during real-world driving tasks using physiological sensors. Intelligent Transportation Systems, IEEE Transactions on. 2005 Jun;6(2):156-66.

[13] Kulish V, Sourin A, Sourina O. Human electroencephalograms seen as fractal time series: Mathematical analysis and visualization. Computers in Biology and Medicine. 2006 Mar 31;36(3):291-302.

[14] Karthikeyan P, Murugappan M, Yaacob S. Detection of Human stress using Short-Term ECG and HRV signals. Journal of Mechanics in Medicine and Biology. 2013 Apr;13(02):1350038.

[15] Kulic D, Croft E. Anxiety detection during human-robot interaction. InIntelligent Robots and Systems, 2005.(IROS 2005). 2005 IEEE/RSJ International Conference on 2005 Aug 2 (pp. 616-621). IEEE.

[16] Sharawi MS, Shibli M, Sharawi MI. Design and implementation of a human stress detection system: A biomechanics approach. InMechatronics and Its Applications, 2008. ISMA 2008. 5th International Symposium on 2008 May 27 (pp. 1-5). IEEE.

[17] Guang-yuan L, Min H. Emotion recognition of physiological signals based on adaptive hierarchical genetic algorithm. In2009 World Congress on Computer Science and Information Engineering 2009 Mar 31 (pp. 670-674). IEEE.

[18] Costa G. Occupational stress and stress prevention in air traffic control. International Labour Office; 1996.