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# A Review on Advanced and Latest Methods for Mental Solace

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**Abstract:- The concept of stress is emerging as a topic of utmost importance in an individual's life. Stress serves to have a strong impact on the various aspects of our life, adversely affecting our moods, work performances, relationships and energy levels. Occupational stress is one of the most important perspectives of stress which is affecting the working community on a large scale. A survey on the stress levels on working professionals occupying different designations and the scenarios that poses a load on them has been conducted and the results have been evaluated and tabulated. Since people are acquainted with the negative impacts of increased stress, there is a huge quench for various applications and advanced devices that resort to measure and assess the intensity of stress in real-life on a daily basis. The latest scientific evolution and technological developments help researchers and aids them to build and find new techniques with the help and development of advanced methods and approaches. This paper explores the traditional methodologies adapted to assess stress and also discusses the latest methods of stress assessment that forces to reject the conventional techniques.**

***Keywords:-*** *Stress; Traditional Approaches; Modern Techniques; Questionnaires;*

## I. INTRODUCTION

On the predominant note, what is stress? Stress is a feeling of emotional or physical tension or is better defined as the reaction of the human body to any new and varied change that demands an adjustment to cope with the change or respond to the varied change. It describes a body's methodology of responding to any kind of demand or threat. In short bursts, stresses are often positive. With a real or imagined danger fast approaching, the body's defense mechanism is activated leading to a rapid and fast process. This automatic process is called as "fight-or-flight" reaction. This is often termed as stress response. This is the body's mechanism of safeguarding you. When the response is correct, an individual faces each day with high levels of energy, remains focused and alert. This helps to save an individual in an emergency situation by providing an extra ounce of strength to defend oneself.

To quote an example, it helps you to avoid an approaching danger or to meet a deadline. It will also aid us to rise up to meet new challenges and tasks. It is what keeps us constantly on our toes in the context of an important presentation or one that sharpens our concentration in a challenging mind game. Beyond the safe levels, the helpful aspects of stress changes into a damaging one which adversely affects the quality of life. If you find yourself being constantly under immense pressure and difficulty, it's time for fast action as time has arrived to take action to take a U-turn and bring your system back into action and balance.

Stress that prolongs for longer and extended periods of time will cause negative repercussions and harm your health to the core. Considering the medical or biological perspectives, the definition of stress can be framed as a physical element of consideration or an emotional factor that leads to physical disturbances or mental topsy-turvies. Stresses can be due to internal or external factors. The external factors contributing to increased levels of stress include effects from the environment, psychological or social circumstances. Stress resulting from an illness or from a medical procedure form the list of internal factors leading to stress.

Digging a little deeper into the history of stress, this term was borrowed from the field of physics, where it was initially used to describe the force acting of the surface concerned, by the father of stress research Hans Selye. He began commonly referring to this term after completion of his medical training in the 1920's. His eyes caught the attention of all his hospitalized patients, even though differed in the diseases they were suffering from, they all looked sick to quote as a similarity among the patients. He proposed that they all were under physical stress and in his perspective, stress can be defined and structured as a non-specific strain on the body caused by the irregularities in normal body functions.

There are different kinds of stress that exists, each type with its own characteristics, each with varied symptoms, and each having specific duration, medication and treatment approaches. The first in the category is psychological stress. This special type of stress mainly focuses and deals with cognitive and emotional stress having the trigger parameter as self-criticism, anxiety etc. People going through tough times in their relationships and facing marriage difficulties are the set of people who suffer from psychosocial stress, which occupies the second position in the list. While physical stress is mainly concerned with the physical reactions of the human body, the acute stress proves to be severe since it demands and asks for an immediate reaction of the body to new changes and happenings, also find a place in the list. Episodic

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acute stress is defined as the stress when frequent acute stress is experienced and short-tempered, irritable, and anxious people are prone to experience this category of stress. If the duration of acute stress stays longer, it changes into chronic stress and can harm people's health resulting in fatal results including depression, heart problems etc.

## II. STRESS INTELLECTUAL VIEW

### *A. ELEMENTARY CONCEPTS*

The single-modality approach to measure the causes and effects of stress would not prove to be efficient and acceptable, as some experimental results demonstrate [3]. In real practice, to conduct accurate and precise stress measurement, the best one considered is a multi-modal approach. Fig 1 represents a comprehensible multi-modal aspect on stress [1]. The dissection of this Fig comprises of 2 parts. The upper part is mainly concerned with the predictive aspect of stress while the lower part of the figure deals with the diagnostics aspects.

The first block included in the upper part is the Predictive part which takes into account and considers aspects like Context, Profile, Goal and Trait for analysis. The Context refers to some meaningful information which is used to describe the different varied dimensions of the individual, concerning to the historical, economic and social contexts. The effects of socioeconomic status [4], the social context or social perspective [5], [6], [7] or individual economic situations [8] are just a few in the list.

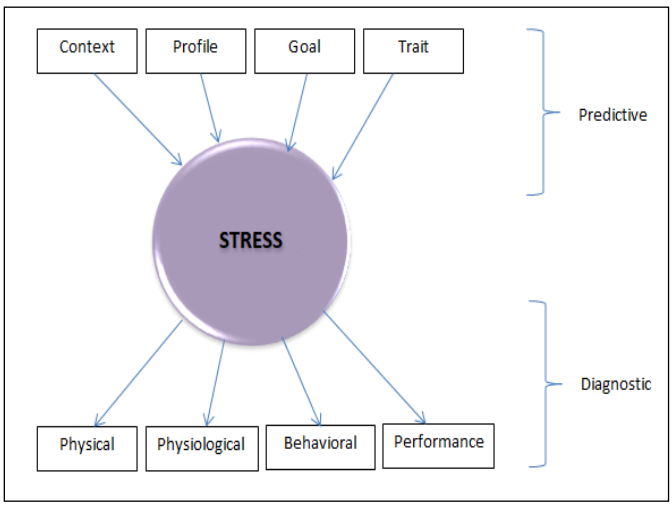


Fig 1: The stress recognition model

The Profile of the individual is concerned with the personal information of the person and characteristics that have a constant and direct impact or influence on the level of stress. Age and gender of the concerned individual, marital status, number of dependents [9] etc. are just a few to name.

The Goal of the individual has the objectives, aspirations or ambitions in the list, also has a significant impact in determining the stress levels. People with higher and top ambitions are known to experience increased stress levels which comes as a result of continued and constant effort to achieve greater or at least reach above the set standards [11].

Trait is used to compare, understand and relate to the personality of each individual. These include the habitual patterns of behaviour, thought processing or emotions [12]. To quote an example scenario, an impulsive and anger drooling individual experiences more stress leading to his hasty and impulsive decisions.

Paying attention to the diagnostic part of the model, a whole list of components takes a place in the list. Those which are oriented towards psychological or inclined towards psychosomatic diagnostics take a place in the list. But the main focus here is in the objective measure rather than subjective measurements, especially those which are able to provide real-time and accurate feedback. The components in this model include Physical, Physiological, and Behavioral and Performance aspects.

Physical aspects are concerned with the different body movements and postures. The eyelid movement, facial expressions changes or pupil movements are some of the aspects concerned.

Physiological aspects provide the most reliable, useful and perfect diagnosis of stress. Many physiological indicators with significant precision exist at present times that can precisely evaluate the level of stress.

Behaviour is often defined as the visible end or visible sector of his own inner self. One of the best indicators of stress aside from other aspects is behaviour. We need to give special attention to behaviour while interacting and communicating with the technological devices and equipment that can be acquired and measured within the technological environments.

The last one in the list is Performance of an individual. While optimum and small streaks of stress maximizes the performance and better the productivity, a higher level of stress may tremendously cause an increase in performance temporarily but will not be sustaining.

### *B. WORKPLACE STRESS DISASTER*

Of all the perspectives on stress, the most important and interesting one is occupational stress. Even though this type of stress affects the individuals in a deeper extent at a personal level, this stress type occupies a special position at the organizational level and also has a drastic economic impact.

#### B.1. CAUSES

Work-related stress is remaining as an adverse issue that affects people all around the globe and across various offices. It affects not only causes an adverse impact on the health and well-being of employees, but also has a significant impact on the net productivity and final results of organizational upliftment. Work-related stress is noticed where the demand and expectation from works exceeds the person's capacity to withstand and capability to cope.

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By simple definition, occupational stress is related to the psychological stress linked and related to an individual's job [2]. It has its roots from the pressures and difficulties that do not align with or equate to an individual's knowledge levels, skills list or expectations. Occupation related stress can suffer a tremendous increase when the workloads are excessive and cannot be easily handled or are too low. They occur when the workers are left unsupported by their managers or supervisors, co-workers or other staff. It also happens when they feel as if they have little control and command over the work related procedures and also are de-motivated as they feel that their efforts on the job are insufficient. This perspective of stress poses as a concern for both parties as stressful job conditions are closely related and linked to employees' emotional well-being and finally affecting the job performance.

Some factors of stress which commonly causes work-related stress include long hours of tiring and sedentary work schedules and heavy workloads that need to be completed before the deadlines. There are different changes in the organization which can cause an increased stress levels too. Constant duty changes can make an individual difficult to cope up with the job and job related pressures.

Job insecurity, lack of autonomy and boring work are another set of causes that leads to increased stress levels in employees [2]. All the workers may not be blessed with the same level of skills and knowledge expertise. This can cause a feeling of insecurity and can lead to stress. Over-supervision, inadequate and insufficient working environments and lack of proper resources also are job related issue which can slowly translate to occupational stress.

The organisations' top managerial staffs sometimes harass the employees and this can lead to poor relationships with the colleagues or boss. This creates a feeling of discrimination in the employees' minds and can gradually shape into stress.

The second aspect considered is the resources they have to deal with. These include the achievement of work goals including opportunity for personal development and autonomy.

This model not only considers the negative aspects and outcomes of stress but also considers the positive and good indicators of employee well-being.

Table 1: Analysis done to measure the causes of occupational stress in an IT enterprise (scale: 1- never affected, 2-less affected, 3-neither safe nor prone, 4-slighty affected, 5-extremely affected)

| CAUSES | PARTICIPANTS | | |
|---|---|---|---|
| | MANAGERS | SOFTWARE ENGG. | ADMIN STAFF |
| Long hours | 3 | 5 | 3 |
| Heavy workload | 3 | 5 | 2 |
| Tight deadlines | 4 | 4 | 2 |
| Job insecurity | 1 | 4 | 1 |
| Insufficient skills | 2 | 4 | 2 |
| Poor relationship with heads | 1 | 3 | 3 |
| Harassment | 2 | 4 | 4 |

From the analysis and deep inspection of the literature, several causes and valid reasons for companies not implementing active stress management initiatives can be figured out.

Some of them are the necessity for human experts, the needed changes in the established, available and developed work routines, the cost factor and the unwillingness and preconceptions of employees to participate.

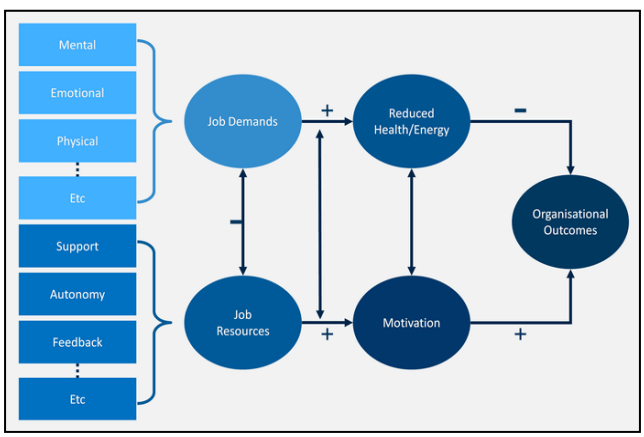


Fig 2: The Job Demand Control Model by Robert Karasek

## III. HISTORICAL APPROACHES

Stress management consists of a good spectrum of techniques and methods needed for controlling and analyzing a person's level and depth of stress with the motive of improving daily life functioning. Effective stress management not only helps us to break the negative bond that stress has on your life but helps us to lead a productive and peaceful life. The ultimate goal in everyone's life is a balanced and controlled life with accurate slots for work, relaxation, and fun—and the strength to hold up under difficult times and pressure and meet challenges as it comes.

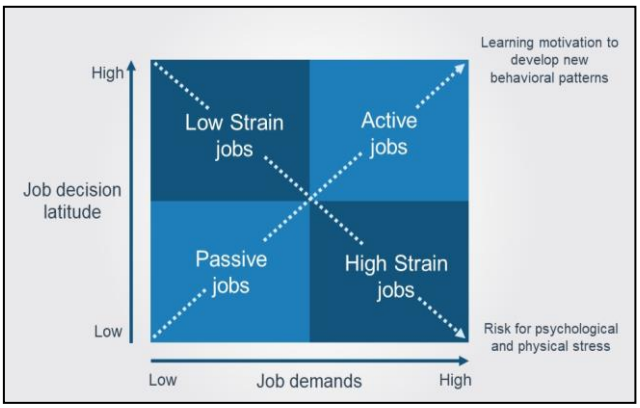


Fig 2: The Job Demands-Resources (JD-R) Model

All stress management techniques requires to answer two main and imperative questions namely to what extend an event is affecting the employees deeply and negatively and which are the best possible methods to help deal with these negative effects. After the state of stress is identified, we need to adapt to various techniques for its management. The main challenge lies in choosing the best and most appropriate timing and approach and also the possibility of implementation of the technique [1]. Human experts serve as the primary resort to resolve this issue. But this represents a cost that prevents the organizations from accepting this alternative and limited availability of both the parties also marks as one of the issues. The frequent reluctance of employees to discuss their issues in the workplace also poses as one of the limitations of this technique. Traditionally, 2 main approaches were followed to quantify and analyze the stress levels of the workers. Among the techniques are questionnaires or surveys and traditional physiological sensors.

Questionnaires are one of the psychology based approaches [15]. By simple definition, it is a set of printed or written questions with a specific set of options or choice of answers, mainly for the purpose of a survey or for a statistical study. They are self-reporting mechanisms and are inexpensive techniques used to collect and store vast and enormous amounts of data and information. The procedure is effortless and can be administered by anyone without affecting the validity and reliability. Even though the procedure seems simple, they do not prove truly efficient. There are disadvantages related to the formulation of questions. The questions are generally dependent on subjective concepts like good, poor, big or low. To deal with this issue, individuals decide not to answer the set of questions or use the most suitable option that their view closely relates. The technique provides ease for the participant to unconsciously hide the necessary data or voluntarily lie and not be open about the facts [15]. At the decision making moment, the researchers themselves take their own assumptions and decisions.

Even if the participant feels an issue being significantly important, absence of efficient means to express that as there are no specific set of questions related to that issue is present in the questionnaire. Some of the frequently used options, such as never are easy to define while others such as frequently used are less clear. When they are concerned with the behaviour of the individuals in a specific context, e.g. “How would you react if you are given a task to complete in a short span of time, amidst you feeling extremely tired?” There is no guarantee that the actual behaviour of the individual falls in the list of answers provided. Thus, dishonest answers, unanswered questions, differences in understanding ad interpretation, difficulty to convey feeling and emotions and difficulty to analyze questions serves as some of the disadvantages of this traditional stress assessment technique.

There were many traditional applications of physiological sensors used as a medical approach for stress assessment. One of the most precise and acceptable indicators is the adrenocorticotropic hormone (ACTH) which is used as a medication and diagnostic agent. It is a polypeptide tropic hormone produced and secreted by the pituitary gland. It activates the glands present in the kidneys to produce cortisol.

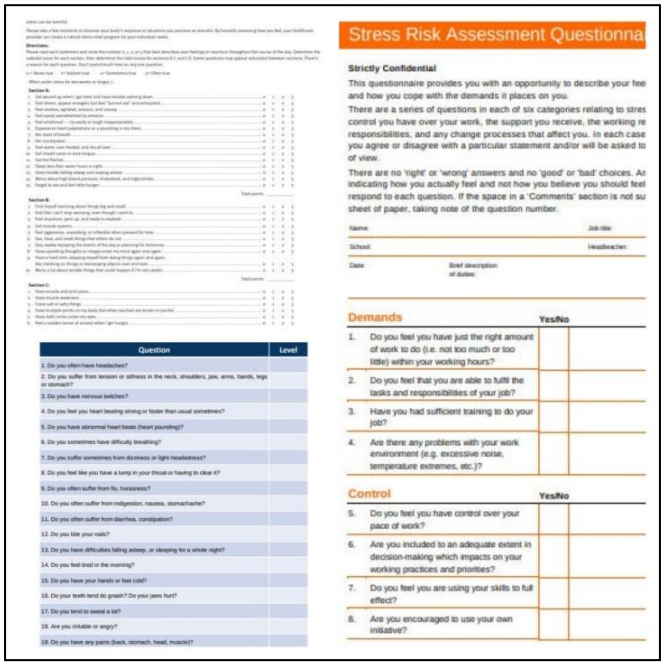


Fig 3: A collage of questionnaires

Cortisol has a list of functions and duties it has to satisfy. It helps the body to use sugar which is glucose and fat for metabolism. This is also very important to help the body manage the different aspects of stress. The cortisol

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levels are affected by many conditions including physical stress, emotional stress, injury or strenuous activity. The cortisol levels can be measured from the hair strands, blood or saliva. Blood tests are used to measure cortisol [19].

Various sensors or their suitable combination can also be used. Yet another example is measuring skin conductivity. It measures the skin resistance, which varies according to the level of perspiration, to electric current. The skin temperature is one of the widely accepted and commonly acknowledged indicators for the study of stress [21].

The main drawback when such sensors are used is the discomfort. This can lead to rejection to participate, especially when there are wires and other hardware parts are associated with the sensors, thus limiting movement.

These factors make it more difficult to collect the required and necessary statistics and data. There can also be undesirable effects on the variables under study caused by monitoring.

Fig 4: Cortisol Test

## IV. PRESENT-DAY METHODS

Stress related mental issues are a growing cause of employee sickness. Workplace stress has to be effectively dealt with and thus their assessment techniques are chosen with utmost importance. New and latest adapted methods for stress assessment were developed.

### A. WEARABLES

Wearables or wearable technology are smart devices that are the latest trends in the stress management. The research and development of these techniques occupy an important place in health monitoring and their impacts in the healthcare industry [1]. The devices designed for acquiring physiological signs were a major development in the field of consumer electronics. The smart devices are worn close to or on the surface of the skin to detect and analyze the information and give immediate feedback to the wearer. These techniques constitute a more comfortable approach than the traditional approaches.

In a research conducted by Natural HR, a top Cloud-based HR Company, one in six consumers currently own and uses wearable technology. The advantages that give this technology an extra boost to be used among workers include increased productivity levels and high levels of employee satisfaction. In [28], the authors analyze the power of electrodermal activity (EDA) to distinguish stress from cognitive load. The procedure uses a wrist-worn device, where the sensors are placed as strips which are attached to two fingers. The skin conductance is related to the number of active sweat glands, an ideal measure for sympathetic activation and thus leads to stress reaction. The EDA is recorded by measuring the amount of conductivity of the skin. The relationship between conductance of the skin proportional to the sweat secretion is measured.

### B. WELLNESS MOBILES

The evolution that the field of smartphones is experiencing has been tremendous in the past few decades. Another new paradigm is wellness mobiles. The developments in this field, facilitates health care professionals and doctors and the patients themselves, to have a comprehensive real-time patient data. This allows the users to continuously track their health and to get real-time advices. The devices also aid to get warnings at the right time. The inventions and developments in this field are uncountable and lead to the production of personal wellness dashboards to measure our heart rates or body temperatures and to analyze our state of health. Their low cost and availability perspectives make them reach a larger crowd.

### C. COMPUTER VISION

The most frequently used image source to monitor stress is the Human face. Cultural differences can intensity facial expressions, but there is evidence that emotions are being communicated differently across different cultures, age and gender [29]. We can apply optical computer recognition algorithms to detect the facial changes.

With the aid of optical scanners, the first step can be performed, i.e. to obtain photographs of the face. An initial image can be captured and preserved in this way. The majority of images obtained are black and white in nature, and OCR scanner should be able to threshold the images obtained. In other words, any pixel in an image should be replaced by a black or white pixel. This forms the first step in

the process - image segmentation process. The goal of pre-processing is to make raw data into a usable and good format by the computers. The noise levels optimized and areas outside the boundary of the picture should be removed. Pre-processing is done to get a clean and perfect image for better image recognition. The segmentation is aimed at grouping each section into meaningful chunks. The feature extraction step means splitting the input data into a set of features. This is important to get all the essential characteristics which make one image varied from another. After getting all the features are perfectly extracted, they can be given to a neural network (NN) to train it to recognize different sections. To get the best possible results and to achieve the best outputs, a training dataset will be helpful. The post processing stage is the refinement process and finally the stress levels on the different and varied features can be calculated.

D. LINGUISTIC FEATURES

This section is concerned with vocal cues such as speed, rhythm or intonation for stress assessment and measurement. The accuracy of speech recognition will reduce severely depending on the variability introduced. Thus the importance of these methods is to improve the robustness of systems [31]. Approaches based on prosodic or acoustic features are also used. Speaker independent prosodic features and vowel quality features acts as terminals to classify each vowel into different categories and are used for the automatic detection of rhythmic stress in English. The feature set includes features like the duration, the loudness and emphasis.

E. MOUSE DYNAMICS

This group of methods is considered non-intrusive as they completely rely on the usage of the mouse with no additional add-ons or hardware requirements. This approach comes under the so-called Mouse Dynamics field. To collect physiological signs when the user is in contact with the mouse can be made possible by building sensors into the mouse [30]. It is also used to acquire physiological variables that correlate to stress. By estimating the pressure exerted on the mouse, a capacitive mouse that measures the amount of hand contact can also be build and set up. Conclusions state that the frequency of mouse contact is significantly higher when individual or participants are under stress. There are systems that capture muscle stiffness during mouse movement depending on how and the way in which the users move the mouse and can easily define and propose a simple model of arm-hand dynamics. Other authors have also extracted and derived behavioral features from mouse usage to understand features such as mouse speed, inactivity, or mouse click rate.

F. SYSTEM KEYBOARD

Researches using computer system keyboard device to assess the effects of stress are on the rise. Keyboard Dynamics is a result of this effort. It analyses the behavior of the user while he/she is trying to type through features such as key latency or writing speed. The authors use both the effects of combined keystroke and linguistic features of spontaneous generated text to measure physical and cognitive stress.

## V. INTROSPECTION

Wearable devices incorporate, develop and modify the physiological sensors in accessories to develop a very convenient alternative to previously used traditional physiological sensors, although the person still has to 'wear' the device. The device can be worn for several days together as the battery life compared to the historical alternatives is nowadays relatively large. These approaches can integrate physiological signs leading to very accurate approaches being implemented. The major drawback is their price, since the devices designed in such a manner tend to have a good ransom amount and has a significant cost.

System based on integrated flash is used to measure heart rate and provide quantification depending on the level of stress. This approach has a lower accuracy since it is based on one and only one physiological sign. To continuously collect data over long time, the user has to constantly touch the light of the smartphone, which is impracticable. This type of solution is more suited to periodic analyses. The evolution of such systems can lead to more accurate approaches.

Table 2 shows a summary of the characteristics considered to assess each stress assessment method and a score (1- lowest, 5 - highest) that allows for an intuitive comparison has been provided. There are some characteristics used for comparison. The first one in the list is versatility which quantifies how fit and correct the proposed method is to be used in different domains.

The cost-effectiveness is another parameter used for assessment. While analyzing this parameter, the value 1 denotes a low value of cost effectiveness parameter, which leads to a more expensive and costly method.

Intrusiveness is the third parameter concerned. It quantifies and expresses the extent to which the routine of an individual is affected by the stress assessment method. A value 1 denotes that the method is intrusive level is high while the value 5 denotes that it is completely transparent to the user.

Feature Diversity is the forth in the list. While some methods tend to give a very less or small number of features, others give access to a wide variety and larger number of features. Multi-modal approaches tend to hold a strong potential for increased performance.

Specific Hardware quantifies the degree to which specific additional hardware apart from the necessary parts is required to assess stress. The lowest value in the scale i.e. value 1 denotes that a significant additional hardware to meet the necessity is required for the method to be used while the value 5 denotes that no additional and unnecessary hardware is necessary.

Availability determines and shows, from the point of observation and from the user's perspective, the extent to which the method is easily available. To quote an example,

simply downloading an application is very convenient from the user's perspective.

Privacy is a parameter which quantifies the extent to which a given method can pose as a potential threat to privacy. The value 1 denotes a potentially and heavily threatening method.

Richness is another important parameter used for efficient assessment. Richness parameter compares the methods in terms of the richness of analysis. All these results are then properly, for the ease of understanding combined in a single device.

The accuracy parameter denotes the accuracy of the approaches concerning stress classification. Observing and analyzing the table in detail, the best method for stress assessment in the workplace is the keyboard. It offers a score of 54.32.

Table 2: Comparison on different methods analyzed for stress assessment

| CHARACTERISTICS | WEARABLES | SMART PHONES | COMPUTER VISION | SPEECH & LINGUISTIC | MOUSE | KEYBOARD |
|---|---|---|---|---|---|---|
| Versatility | 5 | 3 | 2 | 2 | 2 | 2 |
| Cost-effectiveness | 1 | 2 | 1 | 4 | 5 | 5 |
| Intrusiveness | 4 | 3 | 5 | 5 | 5 | 5 |
| Feature Diversity | 5 | 5 | 3 | 3 | 4 | 4 |
| Specific Hardware | 1 | 3 | 2 | 4 | 5 | 5 |
| Availability | 3 | 5 | 3 | 5 | 5 | 5 |
| Privacy | 5 | 5 | 1 | 2 | 5 | 5 |
| Richness | 3 | 5 | 2 | 2 | 3 | 4 |
| Accuracy | 5 | 3 | 5 | 4 | 3 | 4 |

## VI. CONCLUSION

In terms of versatility analysis performed and conducted, methods based on smartphones and wearables are those that score the highest. These scores are highest specifically in the case of wearables. In the case of smartphones, their versatility and their varied nature lies in the ability to develop custom applications which are specially made applications. They use not only the built-in sensors but also external hardware.

Based on the cost-effectiveness factor, methods based on the keyboard and mouse is the best, followed by speech and linguistic based methods. Their cost is nowadays very low, making them a cost-effective approach for continuous stress assessment.

Intrusiveness is the parameter that achieves a higher score, i.e., the one that is more broadly contained in all methods. Apart from smartphones and wearables, stress is assessed from the regular actions of the individual with the devices in the environment. This makes these methods highly transparent.

Since the smartphones and wearables which provide a rich set of features for stress assessment, the feature diversity parameter also scores high.

Analyzing the need for specific hardware, the best methods are the methods based on keyboard, mouse or speech. While considering modern workplaces, the mouse and the keyboard are equipment common used in white-collar jobs. Methods based on computer vision require video cameras and smartphones may require additional sensors and can sometimes need additional hardware and methods based on wearables necessarily require specific hardware. All these factors thus lead to worst scores.

In the availability perspective, the highest scores are given to smartphone, keyboard, mouse and speech since these devices are easily available in the modern times and that it is only necessary to install specific software to start assessing stress.

Concerning privacy parameter, the highest scores are allotted to smartphones, wearables and computer peripherals. In smartphones and wearables, these devices are tendentiously personal and maintain the confidentiality, which gives the user increased confidence on their use. Considering the case of computer peripherals, they can be used to assess stress in a safe way, without needing any prerequisite or knowledge about what content the user is typing.

The methods based on smartphones and on peripherals are the ones that achieve highest scores, in terms of the richness of the analysis. The score is high since it may provide access to features of different modalities. This includes behavioral, physical and physiological.

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Finally, in terms of accuracy, the methods based on computer vision and on wearable devices, especially the ones incorporating physiological sensors are among the most accurate approaches to assess stress. Thus those achieve the best scores.

To point out an absolute best method from among the lot is rather impossible as each section is dependent on the characteristics and constraints of each particular and specific setting. Focusing on the specific problem of stress assessment in the workplace, the methods that generally achieve best results and good score are under the characteristics' list of cost-effectiveness, intrusiveness, need for some specific hardware, availability and privacy are those based on mouse and keyboard. These conclusions are for mostly the sedentary desk jobs in offices.

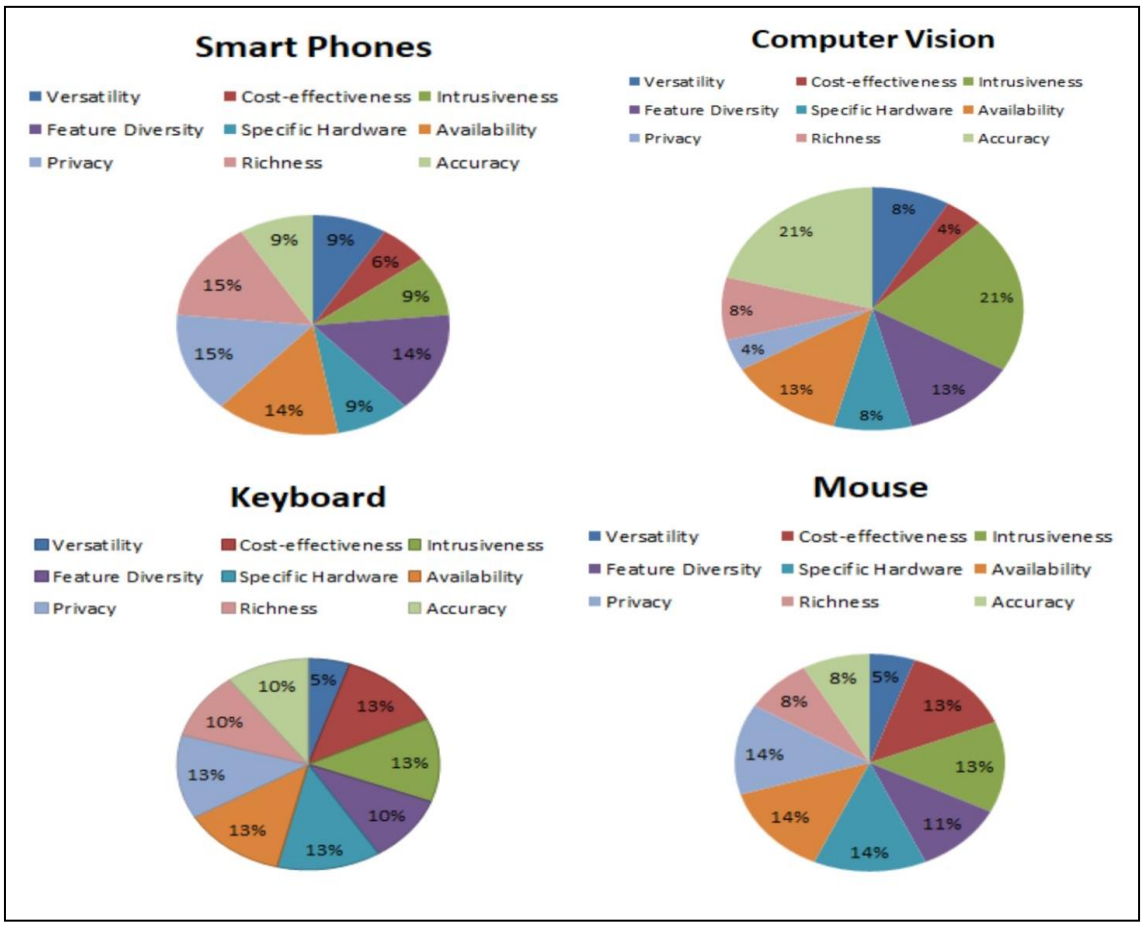
## VII. FUTURE TRENDS

Stress acts as a road-blocker in many cases and have to be dealt with caution. Timely assessment and proper management helps to reduce the negative repercussions of stress. From the dissection of the problem statement, analysis and the models discussed in this paper, we can conclude that stress is present everywhere. Thus there exists diversity in methods used to assess the stress levels.

A few ages ago, many traditional approaches were developed and adopted to assess the stress levels. Among them were the methods like questionnaires and invasive or even intrusive approaches. While the traditional approaches can be suited for medical interventions, they are not feasible to be used for the latest requirements and modern applications.

The historical methods are not suited to be used in the workplace since it will interfere with the worker's routine hindering the constant monitoring. Another major conclusion is that the conventional techniques are suited to assess acute stress more than chronic stress. But in real scenario, it is the chronic stress that needs utmost attention since it hurts the workers the most. Thus the latest methods discussed prove to play an important role by exposing the everyday peaks of stress.

Another important point is the cost factor. Consumers are inclined towards using alternatives that are cost effective and affordable, to log their health and well-being. This is achieved with the use of smartphones or other related devices which stands on their own to collect information about the user or can take the support of additional hardware. There are loop-holes in this technique too. To abide by the smartphone-based approaches, the user is required to stop to collect the information. Approaches based on wearable devices are perfect and prove to be accurate and allow the user to move freely around the environment. But it requires the users to constantly wear them on. Moreover, they also tend to be expensive and costly, if the main aim is to monitor groups of people in an organization.



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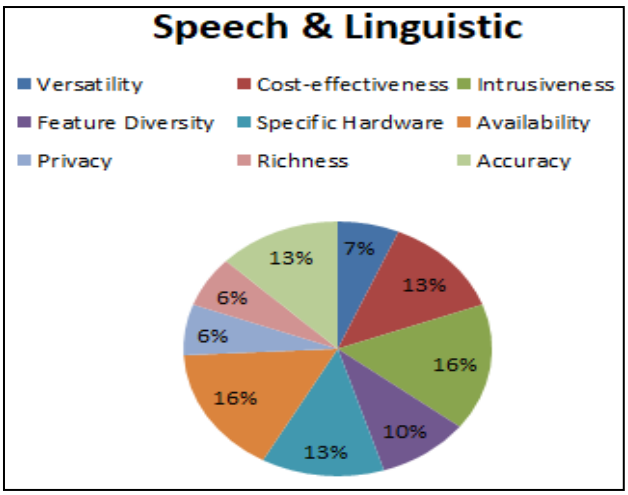


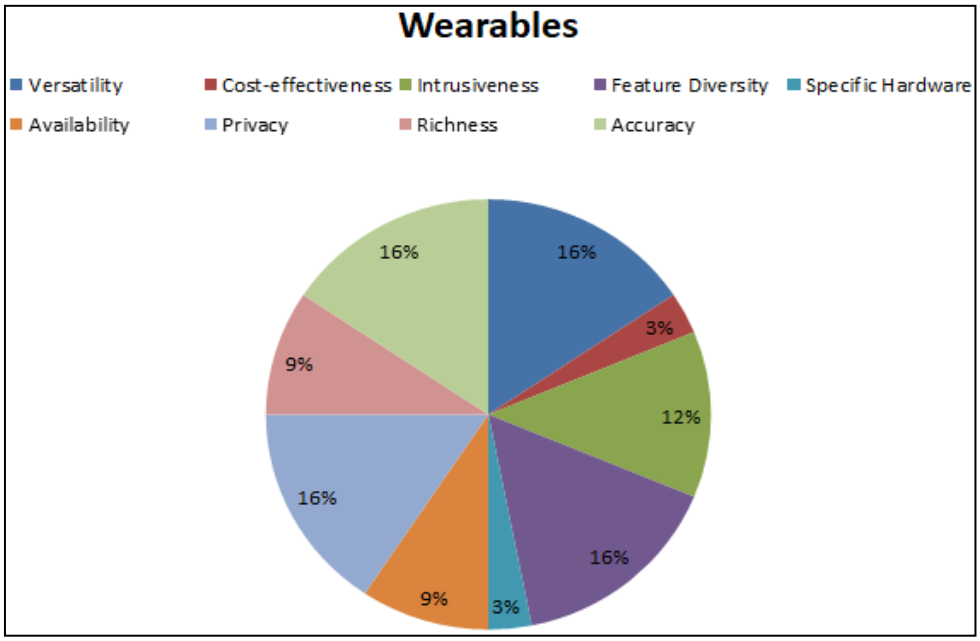


Fig 7: The score in each method in each of the 9 characteristics are evaluated
This can be an obstacle to implement in the workplace.

The concept of Ambient Intelligence can be adopted to monitor stress in modern workplaces and can be used in workplaces such that these technologically empowered environments can simultaneously be sensitive and transparent. In AmI systems, the user is constantly being monitored. It is performed in a way that is completely non-intrusive and transparent. This is made possible through behavioral analysis. In this concept, all the user's actions can be accounted as a potential input. Consideration not only what the user does but how the user does it is also very important.

Our behaviors are commonly associated and are linked with our inner states and actions. Observing someone as restless and observing a person who is biting the nails and we instantly know that the person is nervous or stressed. Our behaviors speak louder than the words we use.

The score in each of the methods with respect to the different characteristics have been evaluated as seen in Figure 7.

Many of our behaviors can be used as input to classify our state. While just one of these features may not be enough to accurately describe the user's state, their combined use or use together as a whole may constitute a reliable source of information.

The main advantage of this approach is its continuous usage throughout the day, without interfering with the users' routines and it turns out to be a transparent, nonintrusive and pervasive technique. It allows for behavioral models to be trained in short time-frames that allow us to know one's frequent behaviors when in neutral states as well as in specific states.

The widely accepted approach in the workplace is the behavioral ones. In these scenarios, approaches based on keyboard and mouse dynamics are especially suited.

This technique safeguards privacy as it is not necessary to determine what the employees are doing, only how they are doing it.

For the field of stress assessment to develop towards high reliability and acceptance, future efforts should be made to develop personalized models that should be trained to shape each individual's reaction to stress, while considering other important aspects such as workload, context, task difficulty, etc. A framework for stress must be defined that incorporates the key stressors in the workplace and their effect on the level of stress. Thus adopting well-defined methodologies to assess stress will aid early diagnosis and will reduce the negative impacts.

## REFERENCES

[1]. Davide Carneiro, Paulo Novais, Juan Carlos and Nicola Payne, New methods on Stress Assessment and monitoring at workplace, IEEE, 8 August, 2015, Vol 14.
[2]. T. A. Beehr, Psychological Stress in the Workplace (Psychology Revivals). Routledge, 2014.
[3]. W. Liao, W. Zhang, Z. Zhu, Q. Ji, and W. D. Gray, "Toward a decision-theoretic framework for affect recognition and user assistance," International Journal of Human-Computer Studies, vol. 64, no. 9, pp. 847–873, 2006.
[4]. A. Soylu, S. Kavukc¸u, M. Turkmen, N. C¸ abuk, and M. Duman, ¨ "Effect of socioeconomic status on the blood pressure in children living in a developing country," Pediatrics International, vol. 42, no. 1, pp. 37–42, 2000.
[5]. G. W. Evans, M. Bullinger, and S. Hygge, "Chronic noise exposure and physiological response: A prospective study of children living under environmental stress," Psychological science, vol. 9, no. 1, pp. 75–77, 1998.
[6]. S. E. Stockdale, K. B. Wells, L. Tang, T. R. Belin, L. Zhang, and C. D. Sherbourne, "The importance of social context: neighborhood stressors, stress-buffering mechanisms, and alcohol, drug, and mental health disorders," Social science & medicine, vol. 65, no. 9, pp. 1867–1881, 2007.
[7]. I. H. Meyer, "Prejudice, social stress, and mental health in lesbian, gay, and bisexual populations: conceptual issues and research evidence." Psychological bulletin, vol. 129, no. 5, p. 674, 2003.
[8]. G. H. Elder and A. Caspi, "Economic stress in lives: Developmental perspectives," Journal of Social Issues, vol. 44, no. 4, pp. 25–45, 1988.
[9]. J. O. Berry and W. H. Jones, "The parental stress scale: Initial psychometric evidence," Journal of Social and Personal Relationships, vol. 12, no. 3, pp. 463–472, 1995.
[10]. L. Fagin, "Stress and unemployment," Stress medicine, vol. 1, no. 1, pp. 27–36, 1985.
[11]. S. T. Tidd and R. A. Friedman, "Conflict style and coping with role conflict: An extension of the uncertainty model of work stress," International Journal of Conflict Management, vol. 13, no. 3, pp. 236–257, 2002.
[12]. M. Vollrath, "Personality and stress," Scandinavian Journal of Psychology, vol. 42, no. 4, pp. 335–347, 2001.
[13]. T. W. Colligan and E. M. Higgins, "Workplace stress: Etiology and consequences," Journal of workplace behavioral health, vol. 21, no. 2, pp. 89–97, 2006.
[14]. B. H. Gottlieb, Coping with chronic stress. Springer Science & Business Media, 2013
[15]. J. Milne, "Questionnaires: advantages and disadvantages," Evaluation cookbook, 1999.
[16]. S. Levenstein, C. Prantera, V. Varvo, M. L. Scribano, E. Berto, C. Luzi, and A. Andreoli, "Development of the perceived stress questionnaire: a new tool for psychosomatic research," Journal of psychosomatic research, vol. 37, no. 1, pp. 19–32, 1993.
[17]. T. Haratani, N. Kawakami, and S. Araki, "Reliability and validity of the japanese version of niosh generic job stress questionnaire," Jpn J Ind Health, vol. 35, p. S214, 1993.
[18]. S. M. Staufenbiel, B. W. Penninx, A. T. Spijker, B. M. Elzinga, and E. F. van Rossum, "Hair cortisol, stress exposure, and mental health in humans: a systematic review," Psychoneuroendocrinology, vol. 38, no. 8, pp. 1220–1235, 2013.
[19]. C. Kirschbaum and D. H. Hellhammer, "Salivary cortisol in psychoneuroendocrine research: recent developments and applications," Psychoneuroendocrinology, vol. 19, no. 4, pp. 313–333, 1994.
[20]. D. H. Hellhammer, S. Wust, and B. M. Kudielka, "Salivary cor- ¨ tisol as a biomarker in stress research," Psychoneuroendocrinology, vol. 34, no. 2, pp. 163–171, 2009.
[21]. A. Barreto, J. Zhai, and M. Adjouadi, "Non-intrusive physiological monitoring for automated stress detection in human-computer interaction," in Human–Computer Interaction. Springer, 2007, pp. 29–38.
[22]. J. Healey, R. W. Picard et al., "Detecting stress during real-world driving tasks using physiological sensors," Intelligent Transportation Systems, IEEE Transactions on, vol. 6, no. 2, pp. 156–166, 2005.
[23]. C. Bruser, K. Stadlthanner, S. De Waele, and S. Leonhardt, "Adap- ¨ tive beat-to-beat heart rate estimation in ballistocardiograms," Information Technology in Biomedicine, IEEE Transactions on, vol. 15, no. 5, pp. 778–786, 2011.
[24]. L. Bernardi, J. Wdowczyk-Szulc, C. Valenti, S. Castoldi, C. Passino, G. Spadacini, and P. Sleight, "Effects of controlled breathing, mental activity and mental stress with or without verbalization on heart rate variability," Journal of the American College of Cardiology, vol. 35, no. 6, pp. 1462–1469, 2000.
[25]. M. S. Schwartz and F. E. Andrasik, Biofeedback: A practitioner's guid Guilford Press, 2003.
[26]. J. F. Lubar, "Discourse on the development of eeg diagnostics and biofeedback for attention-deficit/hyperactivity disorders," Biofeedback and Self-regulation, vol. 16, no. 3, pp. 201–225, 1991.

[27]. A. de Santos Sierra, C. S. Avila, J. G. Casanova, and G. B. D. ´ Pozo, "A stress-detection system based on physiological signals and fuzzy logic," Industrial Electronics, IEEE Transactions on, vol. 58, no. 10, pp. 4857–4865, 2011.
[28]. C. Setz, B. Arnrich, J. Schumm, R. La Marca, G. Troster, and U. Ehlert, "Discriminating stress from cognitive load using a wearable eda device," Information Technology in Biomedicine, IEEE Transactions on, vol. 14, no. 2, pp. 410–417, 2010.
[29]. D. F. Dinges, R. L. Rider, J. Dorrian, E. L. McGlinchey, N. L. Rogers, Z. Cizman, S. K. Goldenstein, C. Vogler, S. Venkataraman, and D. N. Metaxas, "Optical computer recognition of facial expressions associated with stress induced by performance demands," Aviation, space, and environmental medicine, vol. 76, no. Supplement 1, pp. B172–B182, 2005.
[30]. W. Liao, W. Zhang, Z. Zhu, and Q. Ji, "A real-time human stress monitoring system using dynamic bayesian network," in Computer Vision and Pattern Recognition-Workshops, 2005. CVPR Workshops. IEEE Computer Society Conference on. IEEE, 2005, pp. 70–70.
[31]. G. Zhou, J. H. Hansen, and J. F. Kaiser, "Nonlinear feature based classification of speech under stress," Speech and Audio Processing, IEEE Transactions on, vol. 9, no. 3, pp. 201–216, 2001.
[32]. K. Imoto, Y. Tsubota, T. Kawahara, and M. Dantsuji, "Modeling and automatic detection of english sentence stress for computerassisted english prosody learning system," Acoustical science and technology, vol. 24, no. 3, pp. 159–160, 2003.