

Stress Detection using GSR and Reduction using Simulator

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Abstract:- *Stress is a major problem in everyday life, imposing significant and growing health and economic costs on society every year. Stress is one of the factors that affect human health in many ways. It is taken into consideration as one of the culprits in growing the threat of having unwell that might likely cause crucial bodily or intellectual illnesses. Stress can be experienced anywhere and under different circumstances. Therefore, stress needs to be controlled and managed by monitoring its progression or decline. Physiological records may be used to decide pressure levels. One of these is the Galvanic Skin Response (GSR) that utilizes skin conductance which is known to be directly involved in the emotional behavioral regulation in humans. In this study, a method on how to determine stress when a person is in stress is proposed. GSR data were used and it was found that the performance of the proposed method does not differ significantly from a commercially available device. The advanced App may be used to decide pressure tiers mainly if emotional conversations are considered. Stress and riding are a risky aggregate and may result in life-threatening situations, evidenced via way of means of the huge range of street visitor's crashes that arise each year because of driving force stress.*

Keywords: - GSR, Stress, Machine Learning, Graph, Stress Level etc.

I. INTRODUCTION

Stress is often outlined as any sort of modification that causes physical, emotional, or psychological strain. Stress is your body's response to something that needs attention or action. Everybody experiences stress to a point. The method you answer stress, however, makes an enormous distinction to your overall well-being. Sometimes, the most effective thanks to manage your stress involves dynamic state of affairs. At different times, the most effective strategy involves dynamic method you answer the case. Developing a transparent understanding of however stress impacts your physical and psychological state is very important. It is also vital to acknowledge however your mental and physical health affects your stress level. There are many alternative things in life which will cause stress.

A number of the most sources of stress embody work, finances, relationships, parenting, and day-after-day inconveniences. Stress will trigger the body's response to a perceived threat or danger, called the fight-or-flight response. Throughout this reaction, sure hormones like neurotransmitter and corticosteroid square measure discharged. This speeds the guts rate, slows digestion, shunts blood flow to major muscle teams, and changes numerous different involuntary nervous functions, giving the body a burst of energy and strength. Stress can even cause some unhealthy habits that have a negative impact on your health. As an example, many of us deal with stress by intake an excessive amount of or by smoking. These unhealthy habits harm the body and make larger issues within the semipermanent. Some of the various sorts of stress that you just would possibly expertise include

Acute Stress:

Acute stress could be a terribly short-run style of stress which will either be positive or a lot of distressing;

Chronic Stress:

Chronic stress is stress that appears endless and unavoidable; Episodic acute Stress: Episodic acute stress is acute stress that appears to run rampant.

Eustress: Eustress is fun and exciting. It's called a positive style of stress which will keep you energized.

The impact is that the association between your mind and body is obvious once you examine the impact stress has on your life. Feeling stressed over a relationship, money, or your living state of affairs will produce physical health problems. The inverse is additionally true. Health issues, whether or not you are handling high vital sign otherwise you have

polygenic disorder, will have an effect on your stress level and your psychological state. When your brain experiences high degrees of stress, your body reacts consequently. Serious acute stress, like being concerned in an exceedingly natural disaster or stepping into a verbal row, will trigger heart attacks, arrhythmias, and even extra time. However, this happens principally in people United Nations agency have already got cardiovascular disease. Stress conjointly takes AN emotional toll. whereas some stress could turn out feelings of gentle anxiety or frustration, prolonged stress may also cause burnout, anxiety disorders, and depression.

Researchers have developed several ways to investigate physiological signals measured from sensors that area unit hooked up to the soma for stress detection and feeling classification. Previous analysis has shown that analyzing physiological signals might dependably indicate human stress. Ways supported the analysis of physiological signals supply non-invasive ways that to watch stress. Past analysis on the analysis of physiological signals to observe stress has primarily used ancient machine learning approaches. The results are mixed. Much analysis has been conducted on exploitation physiological signals to observe stress.

The majority past approaches analyzed a mixture of physiological signals, as well as signals collected from the electro EKG, electro dermal activity, and diagnostic technique sensors. These approaches detected stress and classified emotions by utilizing ancient machine learning algorithms to investigate physiological signals.

The machine learning algorithms utilised embrace the choice tree, support vector machine, K-nearest neighbour, random forest, linear discriminant analysis. A primary disadvantage for all ancient machine learning approaches is that the demand for handsewn options to be manually generated a lot of significantly, these options haven't been well-tried to accurately represent the physiological signals. There's conjointly no guarantee that the options utilized by the previous approaches cowl the complete feature house of the signal for machine learning algorithms being employed.

II. LITERATURE SURVEY

Ramesh K. Sahoo, Alok Ranjan Prusty, Ashima Rout, Binayak Das & Padmini [1] gave an idea by identifying three different activities with varied positions and sending of galvanic sensing response sensed data to the intended sink node through the heterogeneous wireless communication medium. Roy Francis [2] developed an android application capable of determining the stress level of a person while doing SMS composition. Ramesh Sahoo and Srinivas Sethi [3] proposed three different positions like lying, sitting and standing have been considered with three moods.

Normal, tension, and physical exercise have been considered for three different moods of human life. It has been observed that, the result of GSR value in term of physiological data are constantly varies in respect to surface area contact with body and maximum GSR values observed during tension moods Suja Sreeith Panicker, Prakasam Gayathri [4] used physiological data collection, role of machine learning in Emotion Detection systems and Stress Detection systems, various evaluation measures, challenges and applications. An overview of popular feature selection methods is also presented. [4] also says that an important contribution is the exploration of links between biological features of humans with their emotions and mental stress. The numerous research gaps in this field are highlighted which shall pave path for future research.

Yekts said Can [5] examined the recent works on stress detection in daily life which are using smartphones and wearable devices. Although there are a number of works related to stress detection in controlled laboratory conditions, the number of studies examining stress detection in daily life is limited. [5] also divide and investigate the works according to used physiological modality and their targeted environment such as office, campus, car and unrestricted daily life conditions. J.A. Healey, R.W. Picard [6] detected the stress through the prism of computer science that the focus shifts from stress detection in a constrained environment using less comfortable sensors to stress detection in an unconstraint environment using more comfortable sensors.

III. EXISTING SYSTEM

Psychological evaluation is mostly used as a stress marker or ground truth in stress recognition domains. The common methods are the N-point Likert scale and categorization. However, it should be noted that filling out questionnaires or self-reporting during working is not practical for safety reasons.

MEASURING PATIENT'S INTERNAL PHYSIOLOGICAL RESPONSES

When the human body needs to react quickly to eliminate a stressor, the SNS is activated. The PNS is activated when the body needs to be in a relaxed state. These physiological stress responses can be measured through different bio signals.

CORTISOL LEVEL

The sympathetic nervous activity caused by person stress can be evaluated using salivary cortisol levels

HEART ACTIVITY

During stressful working situations, HR and HRV signal patterns change due to the fluctuations in ANS activities, which indicates patient's stress. Stress is directly related to HR, as stress increases the person's heart rate.

ELECTRODERMAL ACTIVITY

Another reliable physiological signal to detect driver stress is Electro Dermal Activity. A body's physiological response to a stressful situation results in continuous variations in the electrical activity of skin.

RESPIRATION ACTIVITY

Change in respiration activity is a physiological response to stress and emotional state. The respiration system serves as a metabolic and homeostatic regulator of depth and speed of breathing. Stressors can increase respiration activity.

MUSCLE ACTIVATION ELECTROMYOGRAPHY

Muscular reactions caused by stressful situations can occur unconsciously even when no physical activity is required. Stressful situations can affect this reaction by increasing muscle activity which can be measured using electromyography signals.

SKIN TEMPERATURE

Another physiological signal used to detect stress is skin temperature. In stressful situations, SNS activity causes peripheral vasoconstriction in the body, thereby decreasing the driver's skin temperature.

IV. PROPOSED SYSTEM

The below diagram displays an over view of the Stress detection and reduction Model used in this study. The major processing steps that are carried out in the mentioned system are collection and pre-processing of Stress Data, the feature extraction, feature selection, formulation and the Classification.

Three main processes were involved in stress detection.

- Skin conductance data is collected in terms of volt.
- The collected Stress Data were amplified using resistor, and it is processed, analysed and classified.
- The proposed technique detects the stress level in a person and lowers stress if it's above normal using an electrical stimulator.

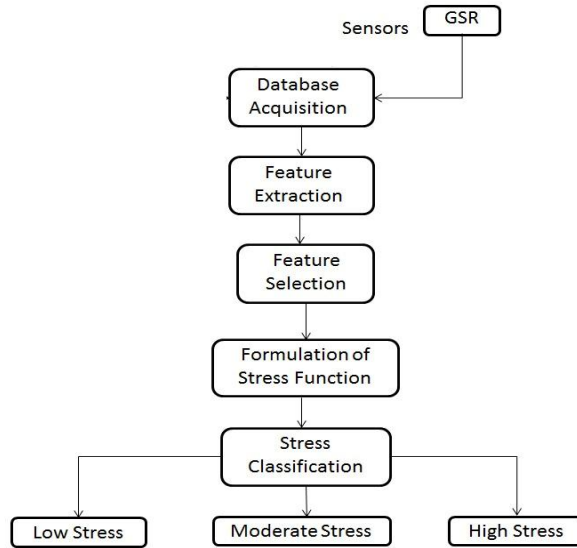


Figure 1: System Design Flow

V. METHODOLOGY

Stress detection includes four broad categories namely IOT sensor node, Wi-Fi module and machine learning. In order to develop an automated system that proactively detects driver stress levels, data needs to be collected, transferred, pre-processed, reduced, integrated and used to make the final decision automatically. To measure the skin conductivity Galvanic skin response is used. The conductance voltage depends on sweat produced by sweat glands which are controlled by nervous system. The conductivity of the skin changes due to sweat secretion and consecutively its voltage. The voltage is measured to determine status of emotions of human being.

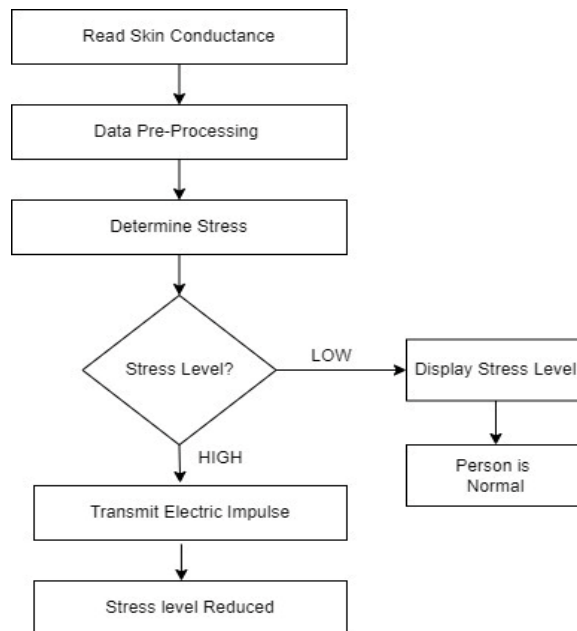


Figure 2: Flow Chart of Proposed Model

The next part is to convert the obtained readings into a set of values that can be graphed. The results were repeatedly analyzed and the processing was recalibrated. After all the GSR data were gathered, the values were converted into its corresponding stress levels. This was done by calculating the mean maximum and mean minimum GSR's of the participants. Given the minimum and maximum bounds, the interval was equally divided into seven to provide stress level points. The average GSR values of the participants during text composition were then marked against their corresponding stress levels in the scale. All stress levels data for each app were then statistically compared. Level of stress is detected using these values. The stress can be viewed using the Mobile Application. Based on these stress levels, the system executes two operations. If the stress level, it is displayed in the mobile app. Suppose the stress of the person is detected high, the electrical impulse is transmitted to the person with high stress which in turn reduces the stress. And thus, the person becomes normal.

IOT Sensor Node

The Internet of Things (IOT) is about interconnecting embedded systems, bringing together two evolving technologies: wireless connectivity and sensors. These connected embedded systems are independent microcontroller-based computers that use sensors to collect data. These IOT systems are networked together usually by a wireless protocol such as Wi-Fi, Bluetooth, 802.11.4, or a custom communication system. The networking protocol is selected based on the distribution of nodes and the amount of data to be collected. In this proposed system, the IOT node helps to collect the data and the Stress level is displayed in Mobile App using Wi-Fi. The processing of data is done using Embedded System containing Node MCU programmed using Arduino IDE.

Machine Learning

Machine learning algorithm is used to predict whether the person is under stress or not. The Machine learning algorithm used in this system is Support Vector Machine (SVM). SVM is one of the most popular Supervised Learning algorithms, which is used for Classification as well as Regression problems. However, primarily, it is used for Classification problems in Machine Learning. The goal of the SVM algorithm is to create the best line or decision boundary that can segregate n-dimensional space into classes so that we can easily put the new data point in the correct category in the future. This best decision boundary is called a hyperplane. SVM chooses the extreme points/vectors that help in creating the hyperplane. These extreme cases are called as support vectors, and hence algorithm is termed as Support Vector Machine (SVM).

VI. RESULT

Mental stress detection could be a key issue for human beings' health. significantly, designation and sleuthing mental stress is important to forestall its dangerous consequences. The developed system was used to detect stress and to reduce stress according to persons stress levels. The system was tested among some persons to analyze the stress. The stress was detected and analyzed. The detected stress was depicted as a graph and were surveyed before and after usage of the system. This section presents the results obtained from various persons.

Stress Detected from Person 1:

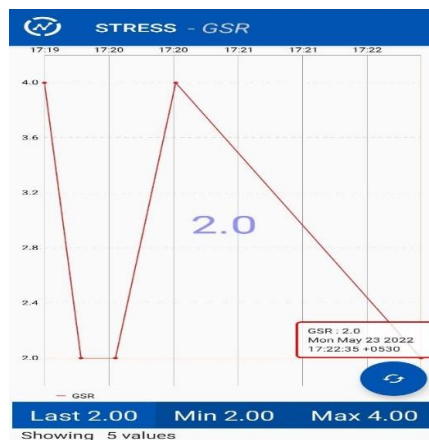


Figure 3: User-1 Analysis

Stress Detected from Person 2

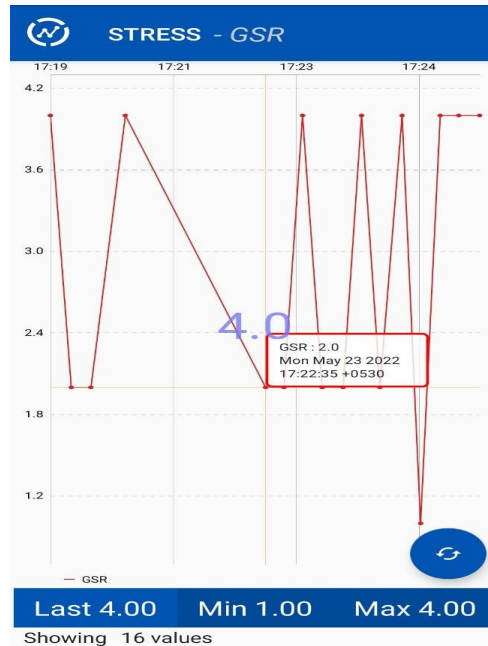


Figure 4: User 2-Analysis

The above two figures show the stress value of two individual person detected at various situations. The maximum and minimum threshold value is 100 and 60. The first figure shows stress level of 2 and the second figure shows the stress value of 4 which depicts low stress level of a person.

VII. DISCUSSION

Over seventieth of individuals expertise stress. Chronic stress ends up in a weakened system, upset, depression, diabetes, and substance addiction. Thus, stress is deeply harmful to physiological health and psychological eudaimonia. it's of preponderating importance to develop sturdy strategies for the speedy detection of human stress. Such technologies might alter the continual observance of stress. As a result, people might manage their daily activities to cut back stress. So, we tend to developed a stress detection system. The system will notice the strain level and can also reduce the strain, once it's not traditional.

The system detects the strain mistreatment electrodermal response and reduces by causing electrical pulses just in case of high stress level. Firstly, the inputs square measure taken from the person mistreatment the device so the developed model analysis the quantity of stress and also the stress level is delineated within the variety of graph by mistreatment the inputs from the assorted folks that has been tested. The longer-term work of the device is it are often developed in a very wearable method like in sensible watch's, handy device, etc., It are often created simply accessible device for people's use.

VIII. CONCLUSION

Stress may be a psycho-physiological reaction to events or demands in regular life. Stress will be elicited by one or a lot of stressors and therefore the ensuing amendment in bodily reactions will be detected by sensors. Stress may be an advanced combination of physiological, behavioural, and emotional responses. And though experiencing stress by itself isn't nonadaptive, prolonged expertise of stress while not sufficient recovery will impede daily-life functioning and contribute to the event of psychopathy.

The developed device will simulate the performance of the industrial Galvanic Skin Response (Thinkspeak) application. the applying will record skin electrical phenomenon and consistently confirm the strain level of someone throughout the contact with the device. the applying was ready to show the strain levels of a personal on the sensible phone within the sort of graph. The strain level was supported the worth of skin electrical phenomenon of the person whereas the person is in stress and in grips with the device. The skin electrical phenomenon recorded by the thinkspeak application was resolute as stress of someone. The determined stress level also can be reduced by the developed application exploitation Associate in Nursing electrical machine.

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