Mental Stress Detection Using Questionnaire

Yash Agarwal , Shahanaz Ayub ,
Electronics and communication Engineering Department
Bundelkhand institute of engineering and technology Jhansi.

Abstract : **Mental Stress is a kind of negative emotions which person undergoes with negative effects due to overload of work or pressure to perfection in different field. Indians faces severly with such type of stress and economic times estimated that almost 46% of Indian workforce faces mental stress. The major challenge which is faced today in India is the perception of this as illness and its symptom of detection. There are classified into two states 1) Positive mental Stress 2) Negative Mental stress. Positive mental Stress is essential part as it boosts the person and encourages person to take risks in life. Whereas the negative mental stress is a condition which not only discourages the person but also makes them to doubt themselves. These could be the sources of many reasons some of them may be due to adherence of daily targets and due to social network which are the main causes of this which brings out the comparison of them with others. Hence brings them down. Some parameters GSR, EEG, EDA etc. are some parameters are of prime importance while calculating the mental stress in wearable device.**

IndexTerms - **EEG (Electroncephelogram) , HR (heart rate), EDA (Electro Dermal Activity), GSR (Galvanic Skin Response)**

I. INTRODUCTION

Mental stress is a kind negative emotion which a person under goes when he overburdens himself this often happens when person faces excessive competition .Hence in order to thrive himself he suffers himself with overburdening of different jobs to himself. Hence it lets him to defeats in his targets as a result of which negative emotions thrives. The negative emotion can be of different kinds and the important ones is the chronic stress whose effects are prolonged. Chronic Stress generally leads variety of disease such as diabetes, hypertension, high blood pressure, mental health problem, migraine. Not only this are its effects too severe in case of cancer patient as it leads to increase in the cancerous which may lead to death of the person. In India itself according to the economic survey 46% of work force suffers from this chronic disorder. And this topic in India is still a taboo since no wants to discuss on it. Not only its effects on cancer patient but cardio patient too by increasing its blood pressure.
The main aim to describe this topic is too create awareness and cope up without spending excessive money on psychologist. One method which we can come up is the method of Questionnaire which is different from the classical method .In such method the sets of questions are prepared and leveled and asked by the user and judged based on the score whether the person is under stress or not.

II. RELATED WORK

Basically there are two types of methods used for the calculation of stress and these can be characterized as invasive and non invasive. In case of invasive the blood flow is tested and cortisol level is measured in the body. In non invasive method the stress is measured by either electro dermal activity or by heart rate but these parameter depends on the resting stage of the user but the user remains dynamic and hence these parameters changes constantly while moving hence such methods constantly fails. We can suggest a method of questionnaire where the user is asked the question while in workplace or while in stress situation. These questions can be asked through different modes whether through mobile, or through computer or through examination but mobiles suits the best in such cases. In such method stress can be detected by two methods firstly calculate the heart rate and EDA during the questionnaire and with the required data stress can be calculated. Other method is calculating the correct answers obtained through user when time is being compressed for the question. The number of correct answer gives the stress level.

III. STRESS DETECTION AND CLASSIFICATION

Stress detection often classified based of the type of stress as previously discussed chronic stress is one of the most dangerous as this stress has severe effects on the person who is suffering from cancer or cardiovascular disease. The common Questionnaire asked from the user related to some common addition, division, multiplication, subtraction problem but along with time compression to detect stress.

IV. METHODOLOGY AND ITS IMPLEMENTATION

Its basic implementation is through displaying question in mobile phone periodically during at work which gives its answers and feeds them and results them based on the correct answer given by him. These questions are asked frequently and with time constraints in it.

So asking of questions generally comprises of Google form which comprises of 5 questions to avoid hectic situation and a person can read easily. The diagram of the questions is shown below.

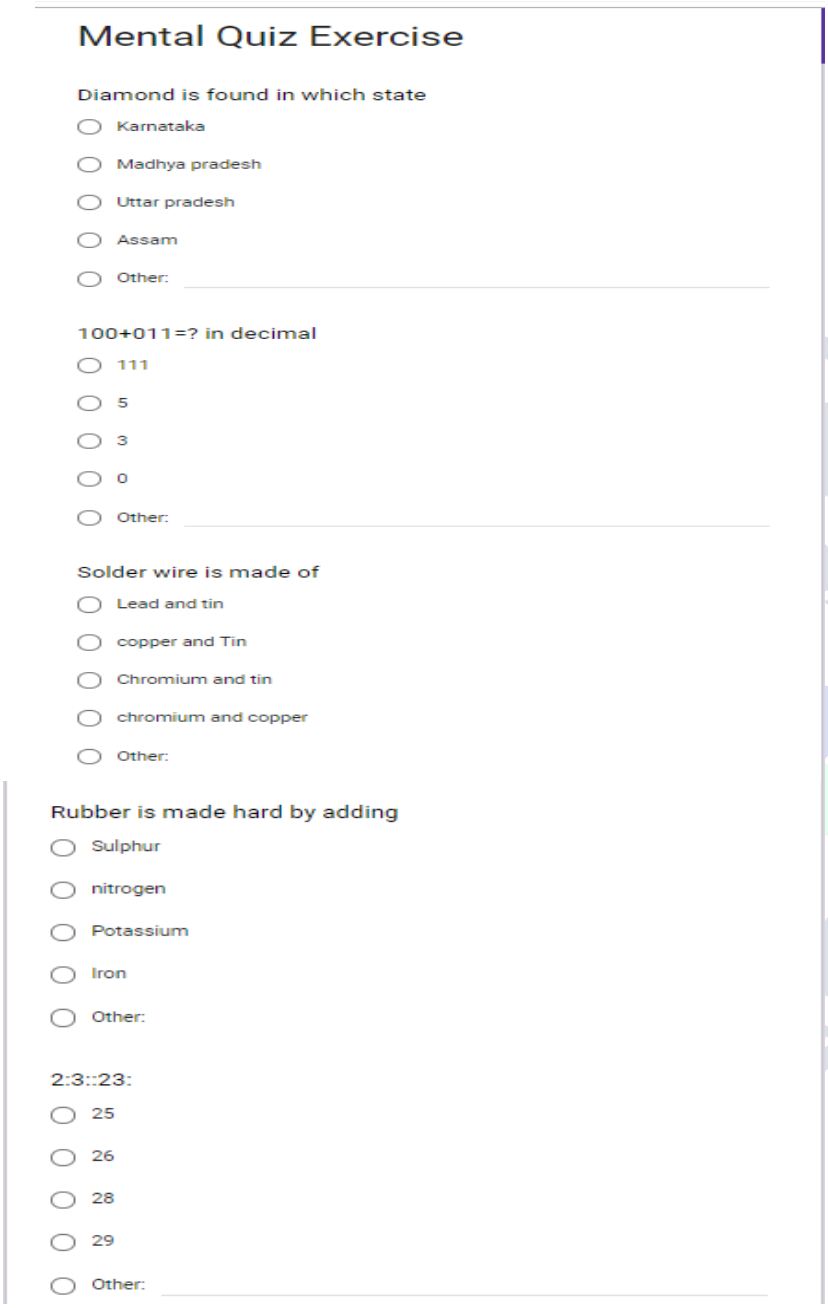


Fig 1.2 Mental stress quiz

Level	Stress(mean+/-*S.D.)*20	Control(mean+/-*S.D.)*20
1	55+/-13.1	74.3+/-7.2
2	41.2+/-10	64.3+/-12.1
3	32.3+/-10.3	61.2+/-12.1
4	22.1+/-11.1	49.2+/-14.5

Table 4.1: Performance in every level of stress and control condition

Level	Stress	Control
1	5.71+/-2.21	9.13+/-2.51
2	4.43+/-2.12	8.64+/-1.82
3	3.81+/-2.34	8.53+/-1.72
4	3.23+/-2.11	7.91+/-1.92

Table 4.2: Average response time in every level of stress and control condition

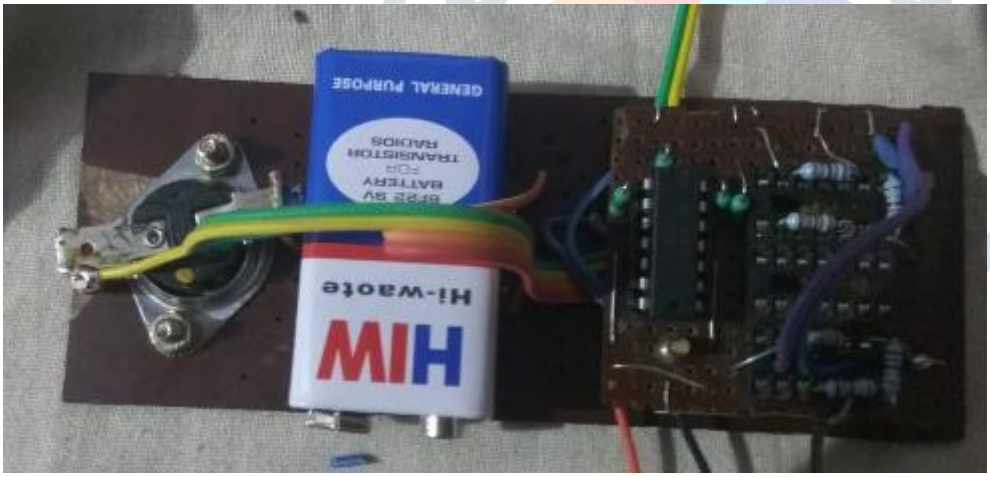
Level	Stress	Control
1	828.61+/-70.22	1358.11+/-364.45
2	1960.2+/-210.12	3349.3+/-863.34
3	2681+/-315.22	4762.21+/-1284.90
4	3076.2+/-288.4	6690.11+/-2070.13

Table 4.3: Average of the subjective response of the tasks in every level of stress and control condition

V- HARDWARE REQUIREMENT

Circuit Analysis

During quiz analysis subject is tested based on its change in GSR level i.e. body resistance whose values are too calculated. The circuit used is shown below.



Here body resistance is measured using the strain guage and the response of strain guage passes through the amplifier which amplifies the response and gives the required output. The methodology of the applied input and signal acquisition is shown below.

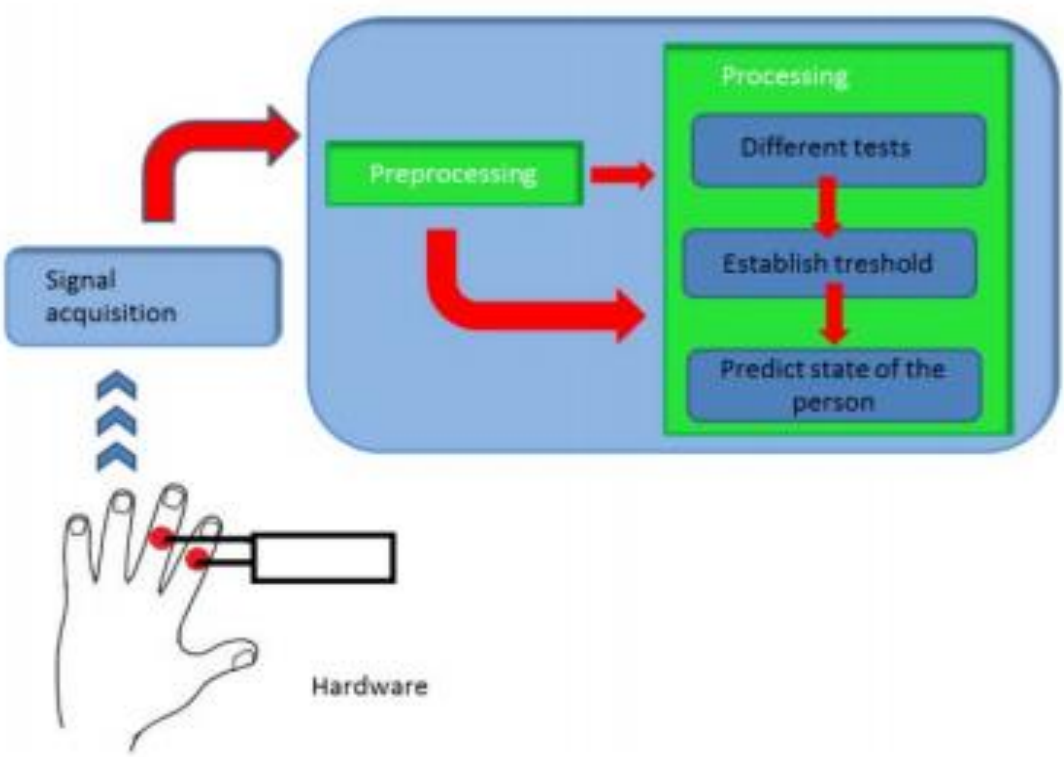


Fig 1.3 Signal Acquisition from the hands of the stressed patient

These signals are acquired either using scalp electrodes or using banana clips which can be comfortably placed on the tips of the fingers and the body resistance can be acquired which are taken across a bridge made of three resistance and unbalanced arm is taken as the body resistance. The resistance changes its value to voltage which is very low and so converted into higher level using the operational amplifier.

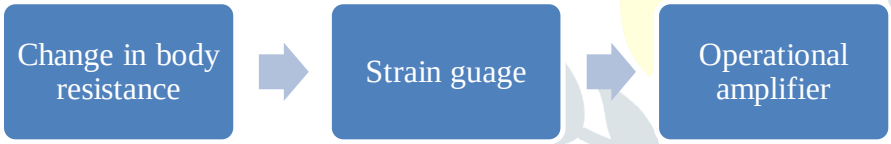


Fig 1.4 Signal acquisition from stressed patient

Data transmitter

A microcontroller board is used as a medium for conversion of analog voltage source to digital voltage source. As a microcontroller board Arduino is used as a medium for signal acquiring and convert them into respectively digital form which can be effectively be processed in the program for data analysis.

For this analysis purpose arduino uno is used which has a 32kb flash memory 2KB SRAM 16MHz clock speed and input voltage from 6-20V which can be effectively suited for the experimental purpose.

Fig 1.4 Arduino board used for data analysis

Software requirements

Arduino IDE 1.8.9 is used in PCs or laptop along with java development environment which can be used as framework for arduino. Data is acquired from a subject on a runtime basis and its data can be plotted on the arduino. Pulses can be seen not only in digital form but also graphical form but as a researcher plots on graphical are clearly visible.

Coding in arduino is generally on C environment which is quite user friendly and can be easily used for quick data responses.

VI SOFTWARE ANALYSIS

The required code is made to run on real time basis and the data is recorded and analysed based on the peaks

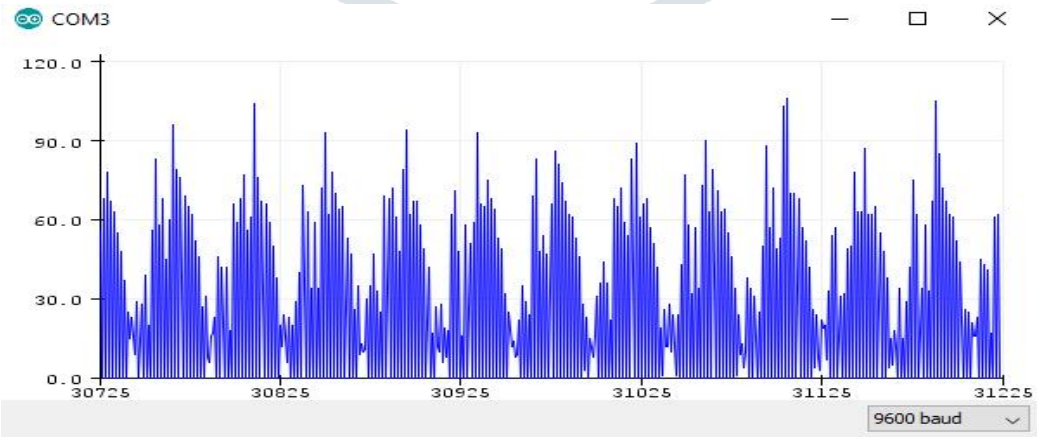


Fig 1.5 Person with Mental Stress

detected under the stressed condition and unstressed condition which can effectively used as a base for the judgement for the detection of the peaks in the mental stress of the patient.

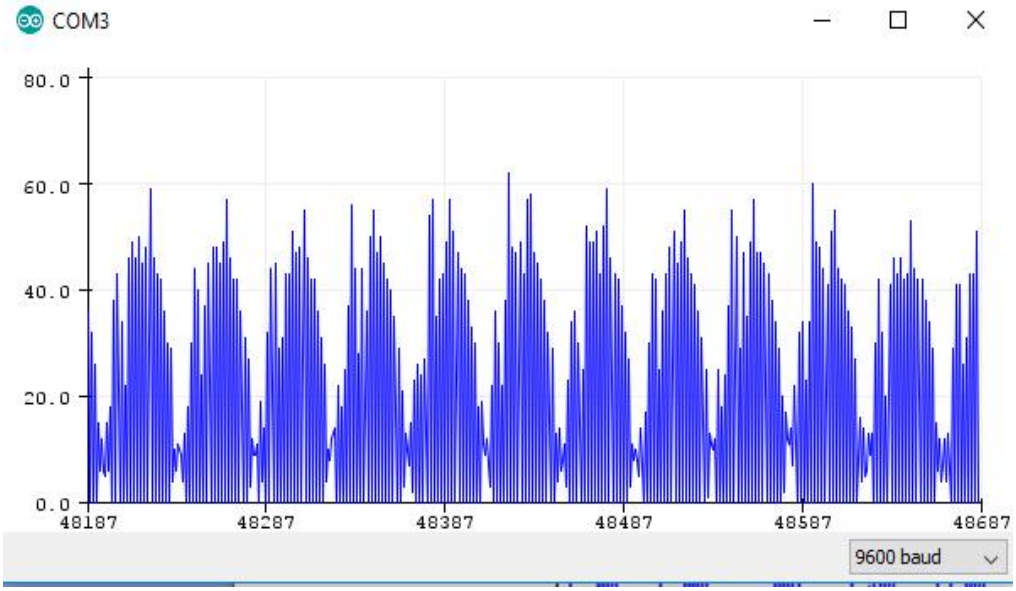


Fig 1.6 Person sleeping

Above values in graph are in mV which are converted in to volts using amplifier which can be standardized after certain point of time.

VI. RESULT

This is been tested on 10 subjects based on it the final result is calculated the criteria of marks are as shown below.
Calm >> voltage of calm patient
Effort >> voltage of effort patient
Distance >> difference from the actual value

USER	Calm	Effort	Distance (%)
1	1.6215	1.7446	7.05
2	1.6219	1.6378	0.9
3	1.5589	1.6157	3.5
4	1.4084	1.6749	15.9
5	1.1284	1.1894	5.12
6	.876	1.0186	1.6
7	1.0011	1.0945	8.5
8	0.8238	0.9581	1.4
9	1.01	1.123	1.118
10	1.060	1.0971	3.38
11	0.7065	.7931	10.91
12	1.0568	1.0812	10.3
13	1.3699	1.5842	13.5
14	.8325	.9581	13.10
15	1.0902	1.1388	1.814

The above table calculates stress of the patient and analyses the data where generalized results can be calculated.
Relaxed state >> 1.14375
Stressed state >> 1.64243
Distance >> 6.34567%

VII. CONCLUSION :

With the above proposed theory one can able to calculate the stress level in a human body by the method of questionnaire. As this is the non invasive method one can easily get through the results and hence can results in wide variety of application. Quiz method can be applicable through mobile or through smart watches as trend is modernizing. With the above quiz method of generating the results of the system we can get an accuracy of 94%.

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