Analysis of Psycho Physiological State under Different Stimulus Using Galvanic Skin Response

Mr.R.PRABHU#1 (Associate Professor), Department Of Biomedical Engineering

A.Priyadharshini#2, J.Sasi#3, V.Shankar#4, A.Sridevi#5

Department of biomedical engineering

Velalar college of engineering and technology

Abstract-Person's response to different stimulus conditions are related with their skin response. An individual response to certain stimulus which is provided by our external world can be estimated with Galvanic Skin Response. In this work we designed a skin response meter in-order to obtain the changes that occurred with varying stress conditions. The amount of sweat creation varies according to the stimulus which provides increased skin resistance. The increased skin resistance value provides increased amplitude. These variations are analysed with MATLAB to analyse the patient's varying resistance to the stimulus.

I. INTRODUCTION

Galvanic skin response (GSR) is used to determine the electrical property changes that results from the amount of sweat secretion under given stress condition. Human skin shows better response to conditions such as anxiety, listening to music and on by giving visual stimulus. For obtaining skin response the suitable place for placing the electrodes are distal and middle phalanx as it contains large amount of sweat glands. The same result is obtained when the

electrodes are placed on the feet. Reason for analysing GSR signals

- It is found to be simple
- Found to be an efficient for analysing autonomic nervous system
- Efficient tool to detect the emotional response of an individual

For obtaining suitable changes in accordance with stimulus a skin response meter is designed with the help of IC LM3915 to which display section and a driving section are connected. The driving section contain diode 1N4148 which acts as a switching diode. The different stimulus conditions are given to the patient. The output obtained from the patient is connected to DSO in order to obtain the signals. Those signals are analysed with the help of MATLAB software.1

METHODS AND MATERIALS

The methods involved are found as designing of skin response meter, interfacing the skin response meter with a communication device and analysing the obtained results under different stimulus condition using MATLAB.

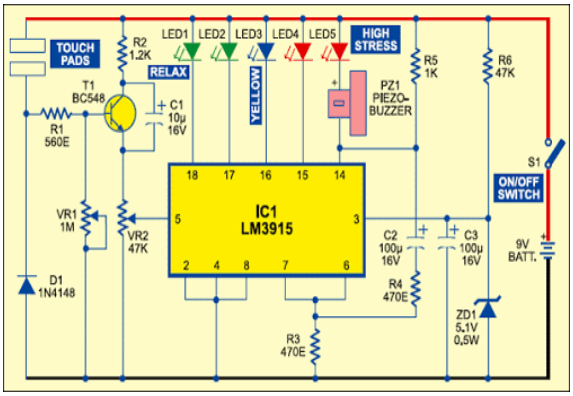

Figure 1: Circuit Diagram Reference: alleceprojects.wordpress.com

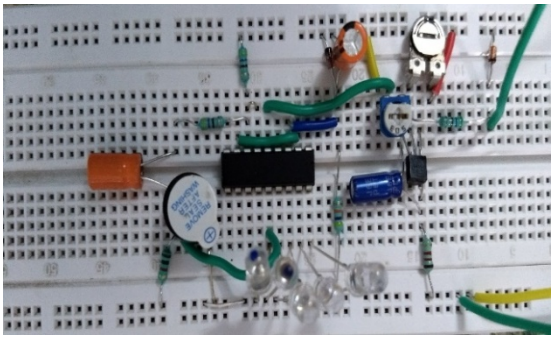

Figure 2: Design of skin response meter

MATERIALS REQUIRED TO DESIGN SKIN RESPONSE METER

- IC LM3915
- Diode 1N4148
- Zener diode
- Capacitors (10 and 100 micro farad)
- Resistors (560, 470, 1k, 1.2k, 47 ohms)
- Variable resistors (47k and 1m ohms)
- LED (red, green and blue)
- Piezo-buzzer
- Transistor BC548

IC LM3915 is configured with LED which acts as a displaying unit through which one can identify the emotional response visually by glowing LEDs according to the stimulus given by the external environment. It also provides sound identification when the stress level is found be high through piezo buzzer.

The main acting component through which the resistance of skin under different stimulus condition is estimated through transistor BC548 which is connected through variable resistor 47Kilo ohms. The one end of the electrode is connected to the base of the resistor through 560 ohm resistor whereas the other electrode is provided

with power supply. By varying the variable resistor value depending on the stimulus and emotional level the sensitivity of the transistor remains steady. The capacitor 10 micro farad provides steady voltage from the transistor.

INTERFACING

The output of skin response meter is connected with DSO to know the changes in amplitude values that occurred under different stimulus.2

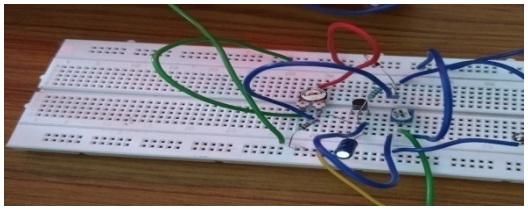

Figure 3: Circuit execution with transistor connection

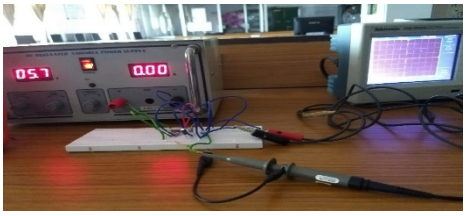

Figure 4: Interfacing with DSO.

The output that is obtained through the DSO is interfaced with a communication device by means suitable software. We used open choice communication desktop to communicate the DSO and our personal computer to perform further analysing the signal that is obtained through DSO using MATLAB software.

II. MATLAB ANALYSING

The obtained signals under different stimulus are analysed with the help of MATLAB software to determine the response of skin under different conditions. The signals are found to contain changes in its amplitude value as the skin offers increased resistance when the subject respond to the stimulus. Those responses are innervated by the autonomic nervous activity of human brain. When the subject is stimulated by the external stimulus their sweat gland becomes activated and the increased sweat decreases the conductance and increases the skin resistance which in turn increases the amplitude values in the signals. Those signals with different amplitude values are analysed with the help of MATLAB software for easier result interpretation.3

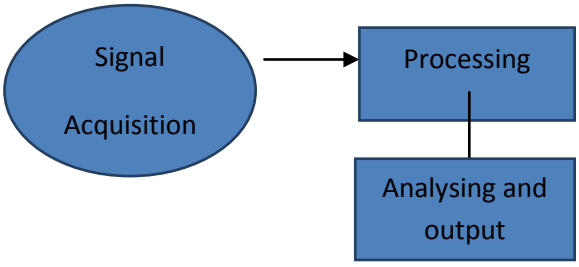

Figure 5: MATLAB analysing

Figure 6: Real time testing

III. RESULT AND DISCUSSION

We have conducted different test on different individuals in order to know their response. The results are obtained based on the following stimulus conditions.

- Relaxing state
- By giving task

Table 1 shows the changes in amplitude values that we obtained under different resistance. The input voltage from the power supply is fixed as 5.7V.

Table 1: Resistance value

S.NO	RESISTANCE VALUE IN ohms	AMPLITUDE VALUES IN volts(V)
1	1K	1.02
2	2K	1.02
3	3K	1.02
4	4K	1.04
5	10K	1.22
6	12K	1.29
7	14K	1.33
8	20K	1.38
9	24K	1.48
10	30K	1.55
11	35K	1.59
12	40K	1.68
13	50K	1.78
14	54K	1.82
15	60K	1.86
16	63K	1.87
17	70K	1.90
18	72K	1.91
19	82K	1.95
20	84K	1.96
21	92K	1.98
22	100K	1.99
23	150K	2.10
24	184K	2.25
25	200K	2.35

The output of the signals under different conditions are estimated using MATLAB

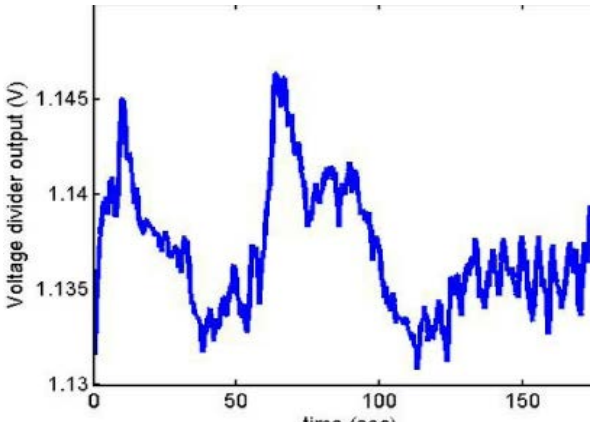

Figure 7: Output of patient on performing task

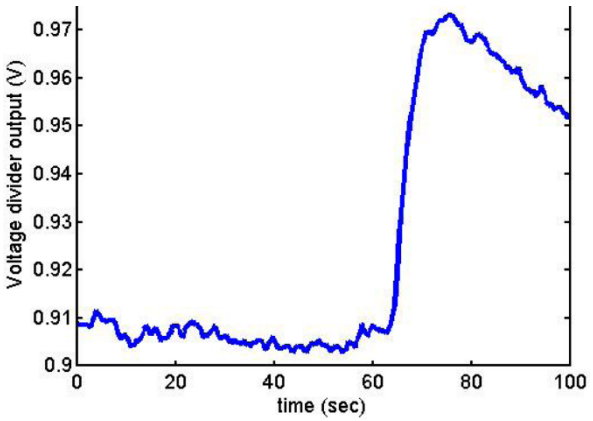

Figure 7: output of patient on deep breathing

The above mentioned signals shows better results under above mentioned condition. The idea is to determine the changes that occurred with skin resistance value as tabulated in the Table 1 with the amplitude value. The signals showing difference in their amplitude value is estimated by using Matlab software. The above mentioned users shows a detailed response to the given stimulus condition. Apart from this we conducted tests on the patients by making them to respond soft music and other positive stimulus, but those things doesn't provides better results. We included the result of two individual showing immense response to the stimulus.

IV. CONCLUSION

Our skin shows response to every stimulus condition by means of sweat gland secretion. The sweat gland secretions cause changes in the electrical activity of skin which can be determined by Galvanic skin response meter by means of applying small input voltage. The changes in the resistance value and its corresponding amplitude changes are estimated and those signals are analysed. By means of analysing these signals one can able to detect whether the individual is in stressed state or in relaxed state. By determining those state we can able to detect the psychological conditions of the person. Increased sweat gland secretion also related with other physiological parameters such as heart beat, respiration rate etc., and it is also related with disorders such as epileptic attack and increased heart rate. By performing the above mentioned details we obtain the changes in the values of resistance and amplitude of the signals with respect to sweat secretion. This can be applicable to determine the stress level of an individual through which the psychological factors are understood and the physiological signal changes can be determined. Our upcoming work is to determine signals for different patient and to classify their responses.

V. ACKNOWLEDGEMENT

We thank Velalar institution for their supportto this workand for the patients from whom the signals taken.

VI. REFERENCES

[1]. Ben-ShakharG ,Elaad E- The validity of psychophysiological detection of information with guilty knowledge test. -2003-psycnet.apa.org
[2]. Barreto A ,Zhai J –Stress detection in computer users based on digital signal processing of non-invasive physiological variables Engineering in medicine and Biology society2006-ieeeexplore.ieee.org
[3]. Mohammad Soleymani, Sander koelstra, LoannisPatras, Thierry Pun- Continuous emotion detection in response to music videos-Automatic face and gesture recognition workshop(FG 2011) IEEE international conference.
[4]. Gustafson LA, Orane MT –The effects of verbal responses on the laboratory detection of deception Psychophysiology , 1965-wiley online library
[5]. Healey JA, Picard RW-Detecting stress during real world driving tasks using physiological sensors-IEEE transactions 2005
[6]. NasozF , Lisetti EL , Finkelstein N Emotion recognition from physiological signals using wireless sensors for presence technologies-Cognition and technology 2004-Springer
[7]. Villarejo MV, Zapirain BG ,
[8]. Zorrilla-Sensor,2012-mdpi.com
[9]. -A stress sensor