International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878 (Online), Volume-8 Issue-4, November 2019

Stress Meter using Pulse and Sweat Sensor

Josephin Arockia Dhivya, S.Akshaya, U.Rithikka, Fathima

Abstract-The stress meter allows you to access your emotional pain. If the stress is very high It gives indications through warning beep, a buzzer. It can predict the stress by change of heart rate using pulse sensor and change in electrical conductivity of skin and its temperature using water sensor. As these rates are provided with the help of Arduino atmega328 UNO microcontroller. A stress alarm (buzzer) is provided to indicate the stress where the stress can be controlled using Haptic feedback motors. We have categorized people with three different types of age like school and college students and workers, as we have provided task for school and college students like mathematical calculations and logical reasoning. For workers the stress is calculated before and after the work.

Keywords: Stress detection,Heart rate, Sweat rate,Haptic feedback motors, Buzzer

I. INTRODUCTION

Human stress is an imbalance state of an individual. Stimulus threatening homeostasis state of the individual is regarded as a stressor, which can be classified into physical one or psychologic one.It is impossible to avoid stress in a working environment. Nevertheless, if people are informed of their stress levels, they may become empowered to take some preemptive measures in order to minimize stress so that stress balance is achieved before it results to serious health problems.Stress management can be complicated and confusing because there are different types of stress — acute stress, episodic acute stress, and chronic stress. It comes from demands and pressures of the recent past and anticipated demands and pressures of the near future. Most people experience acute stress during their everyday life.

Manuscript published on November 30, 2019.
* Correspondence Author
Josephin Arockia Dhivya, Assistant Professor, Department of Biomedical Engineering, Vels Institute of Science, Technology & Advanced Studies, Chennai – India
S.Akshaya, Student, Department of Biomedical Engineering, Vels Institute of Science, Technology & Advanced Studies, Chennai - India
U.Rithikka, Student, Department of Biomedical Engineering, Vels Institute of Science, Technology & Advanced Studies, Chennai - India
Fathima Mahsooma, Student, Department of Biomedical Engineering, Vels Institute of Science, Technology & Advanced Studies, Chennai - India
R.Chandrasekaran, Assistant Professor, Department of Biomedical Engineering, Vels Institute of Science, Technology & Advanced Studies, Chennai – India
R.J.Hemalatha,Assistant Professor, Department of Biomedical Engineering, Vels Institute of Science, Technology & Advanced Studies, Chennai – India

It is a primal flight-or-fight response to immediate stress factors and is not considered harmful. When the frequency of these occurrences increase, physiological symptoms might occur .stress is a pattern of negative physiological states and psychological responses occurring in situations where individuals perceive threats to their well-being, which they may be unable to meet.When we perceive a threat, our nervous system responds by releasing a flood of stress hormones, including adrenaline and cortisol. These hormones rouse the body for emergency action. In some cases it is necessary to collect feedback in order to control this symptom because it can become dangerous in certain situations. Therefore, it is necessary to build a device to detect stress

.Wearable smart sensors are widely used nowadays to capture the physiological and behavioral data in our day-to-day lives to correlate with stress. But, there are hardly any clinical-grade physiological monitors that can accurately quantify stress levels across individuals.

II. LITERATURE SURVEY

Yuhao shan,et all.(2018) Detected and classified the human stress based on depth sensing technique. The detection and classification of human stress is done based on respiratory signals measured remotely by using a Kinect sensor with a Detection range of 3 meters. The proposed method is a promising way for monitoring human stress and even discriminating psychological stress from the physical stress.

Agnieszka Landowska,et all. (2015) designed an emotion monitor stand for tracking human emotions in Human-Computer Interaction using multi-modal approach. The concept of the stand using cameras, behavioral analysis tools and a set of physiological sensors such as galvanic skin response, blood-volume pulse, temperature, breath and electromyography is presented and followed by details of Emotion Monitor construction.

Xiyuan hou,et all.(2015) Proposed Real-time EEG (Electroencephalogram) - based on user's emotion, mental workload and stress monitoring is a new direction in research and development of human-machine interfaces. In this work, they have describe available real-time algorithms of emotion recognition, mental workload, and stress recognition from EEG and propose a novel interface CogniMeter for the user's mental state visual monitoring. The system can be used in real time to assess human current emotions, levels of mental workload and stress.

María ViqueiraVillarejo,et all. (2012) developed by Controlling different emotional situations which can lead the person suffering them to dangerous situations, in both the medium and short term. There are studies which indicate that stress increases the risk of cardiac problems.

In this study we have designed and built a stress sensor based on Galvanic Skin

Response (GSR), and controlled by ZigBee. On completion,the GSR is able to detect the different states of each user with a success rate of 76.56%.

AzianAzamimi,et all.(2012) designed Emotional Stress Indicator (ESI) kit is a wearable sensor device that used to measure the human stress level. Many people out there do not aware about their level of stress that will give a big impact in their life. So this study is aimed to design and develop an Emotional Stress Indicator (ESI) kit which can display stress level among people. This ESI kit is constructed based on human skin resistance which is changed upon condition.

Pranathi Kavuru,et all. (2010) has developed a stress meter based n change in skin resistance, All muscles are not created equally strong and the conditions that stretch them vary from person to person. This equipment consists of sensors or two probes made of conducting materials into the fabric that register the mechanical excitation of the muscle fibers that pass the signals to an electronic analysis system. People's muscle tension changes with their stress level – the greater the stress, the more likely the muscles are to produce a synchronous twitching effect. At the same time, skin offers some resistance to current and voltage. At relaxed state they offer more resistance and at higher stress they offer less resistance.

III. METHODOLOGY

The stress meter is based on the principle that the variations in the resistance of the skin and change in heart rate of one's body can be directly converted and transmitted into analog voltage levels to digital output which gives the visual indication of human stress using a proper circuitry.

The stress meter is to detect the levels of stress using pulse sensor and sweat sensor where it provides the heart rate and electrical conductivity of skin based on change in body temperature, where there is a continuous secretion of sweat by apocrine gland.

3.1.Acquiring data from sensors:

In this proposal, we have taken two basic parameters they are heart rate and sweat using pulse sensor and water sensor. All the data from the sensors will be sent to the microcontroller(Arduino).Microcontroller is programmed in order to indicate the stress.

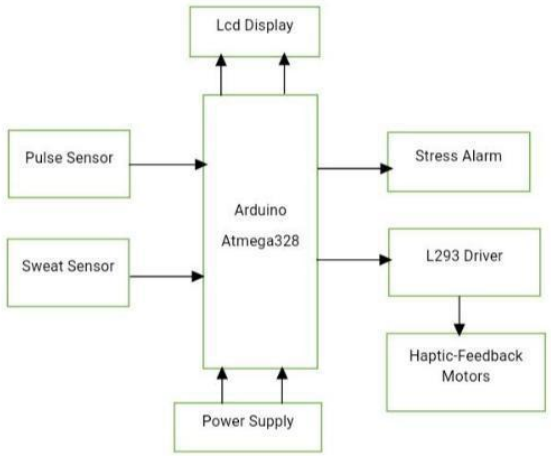

fig.1. Block diagram of Stress meter.

3.2.*Haptic feedback motors:*

Haptic feedback motors are vibrational motors which is acts as therapeutic motor in this module, since there will be increase in blood flow due to increase in stress level where this motor helps in reducing the blood flow which reduces the heart rate.

3.3.*Liquid Crystal Display:*

They are digitalized indicator of pulse rate and sweat rate which consist of 16×2
characters that shows 16 rows and 2 columns of those values.

3.4.*Alarm system*:

The Arduino is programmed in such a way that any increase in heart rate and sweat level from the actual values indicates the user via buzzer, stress alarm.

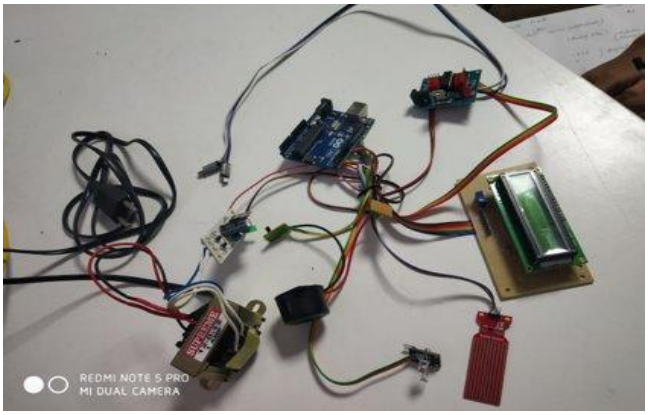

Fig.2. Stress meter using Pulse sensor and Sweat sensor.

***.Technical details*:**

A)Pulse sensor:

KY039:

Fig.3.Pulse sensor for heart rate detection.

The Pulse Sensor is a finger detection heart-rate sensor for Arduino. In addition it is an integrated light amplifying circuit and noise eliminating circuit. It is designed to give

digital output of heat beat when a finger is placed on it. When the heart beat detector is working, for every beat the LED flashes a red light each heart beat. As this sensor works on the principle of light modulation by blood flow in the body through finger at each pulse.

B)Water sensor:

M263

Fig.4.Water sensor for sweat detection.

Water sensor can be used to detect the presence, the level, the volume and/or the absence of water. Here it is used to detect sweat of a person. This sensor is made up of two stainless steel electrodes which is used to identidy the desired point for liquid detection. An activation of current to close one circuit within the sensor generates the signal when the fluid is detected.

C) Power supply:

A Step Down Transformer converts high voltage into low voltage. Here 230V of AC supply is converted into 12V .

A Full Wave Rectifier is a circuit, which converts an ac voltage into a pulsating dc voltage , It consists of a capacitor which removes the ripple noise and a voltage regulator (7805) that regulates the voltage from 12V to 5V to each components.

D) L293 driver:

The L293D is a 16-pin Motor Driver which can control a set of two DC motors simultaneously in any direction. The L293D is designed to provide bidirectional drive current .Due to stress there will be increase in blood flow , to reduce it Haptic feedback motors are given that vibrates at any part of body and provides massage to the particular region.

IV. RESULT AND DISCUSSION

Here we have focused on the basic stress level of a person by carrying out certain task for detection of stress level for various age groups like school, college and workers. For workers we didn't provide any task we took readings for them before the work and after the work.

For school students, logical reasoning and mathematical calculations task is been carried out within 10 minutes . First 2 minutes before the task, stress level has been measured and after the task the output stress value is been noted which is shown in table.1 for school students and table.2. for college students and table.3. for workers.

.The data's collected from the sensors are converted into digital form. From analysis, the stress level is been decreased by 1 or 2 values after the usage of haptic feedback motors. For few members pulse rate has been slow down and for very few members sweat rate has been decreased after using haptic feedback as therapy. The stress level for 36 subjects is analyzed and compared with each other values that is before and after the task from the result that is shown in fig.4 and fig.5.

TABLE.1. Pulse rate and Sweat rate for school students before and after the task.

		PULSE RATE		SWEAT RATE	
SUB	AGE	BEFORE TASK	AFTER TASK	BEFORE TASK	AFTER TASK
1	16	72	78	189	392
2	16	67	68	243	433
3	17	73	79	281	547
4	15	72	77	177	298
5	16	71	72	302	579
6	15	77	80	101	288
7	15	71	74	147	261
8	15	76	79	387	625
9	16	68	75	154	216
10	15	66	72	275	469
11	15	70	71	476	521
12	16	67	69	128	240

TABLE.2. Pulse rate and Sweat rate of college students before and after the task.

		PULSE RATE		SWEAT RATE	
SUB	AGE	BEFORE TASK	AFTER TASK	BEFORE TASK	AFTER TASK
1	21	73	79	408	720
2	20	71	77	185	401
3	19	74	80	239	518
4	20	75	76	340	571
5	20	77	77	178	325
6	21	67	80	211	420
7	20	74	80	164	432
8	21	71	74	288	447
9	21	72	79	315	632
10	19	72	77	147	188
11	22	78	79	343	433
12	19	74	74	199	207

TABLE.3.Pulse rate and Sweat rate for workers before and after work.

		PULSE RATE		SWEAT RATE	
SUB	AGE	BEFORE TASK	AFTER TASK	BEFORE TASK	AFTER TASK
1	28	74	80	312	453
2	25	71	75	482	689
3	32	72	73	168	251
4	37	69	79	203	300
5	31	72	72	275	316
6	29	78	80	292	427
7	36	70	74	305	392
8	28	66	69	144	250
9	33	75	80	465	712
10	32	76	77	168	172
11	34	79	76	237	312
12	29	75	81	465	542

AGE Vs PULSE RATE

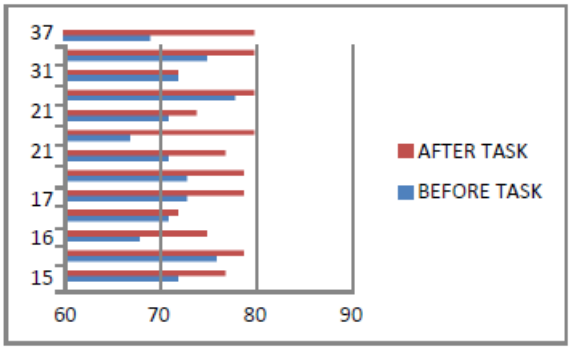

Fig.4.Comparison of pulse rate before and after the task.

AGE Vs SWEAT RATE

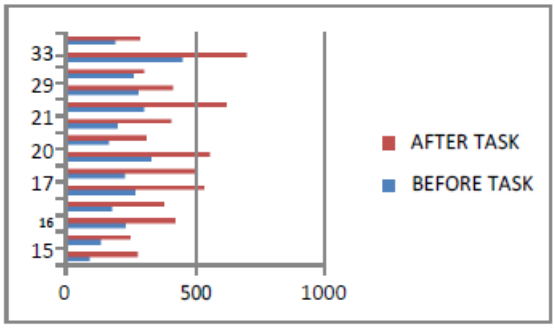

Fig.5.Comparison of sweat rate before and after the task.

V. SUMMARY AND CONCLUSION

The stress meter acquires data from the sensors and displays in digital format which is in binary form. Apart from displaying the outputs there is a buzzer which indicates the increase in stress level of a person. This is achieved by setting a

threshold in the microcontroller (arduino).The threshold is set based on the human normal range of health.

This project is designed to analysis the stress level of humans and to help the stressed person with basic therapy to improve their health. The stress level is compared with the output values and tabulated. Stress cannot be differentiated with basic sensors it can only be compared and analyzed

FUTURE WORK:

Furthermore, this stress meter will be designed in a way that it can be used for differentiating the types of emotions. In the proposed idea, the basic stress is been analyzed and compared with the normal value. But in the upcoming design emotional levels of a person can be identified and analyzed. The stress meter will be implemented with more parameters like
EEG sensors.

REFERENCES:

1. Remote Detection and Classification of Human Stress Using a Depth Sensing Technique. Yuhao Shan,Tong Chen Liansheng Yao, Zhan Wu, Wanhui Wen,Guangyuan Liu (2018)
2. Stress Sensor Prototype: Determining the Stress Level in using a Computer through Validated Self-Made Heart Rate (HR) and Galvanic Skin Response (GSR) Sensors and Fuzzy Logic Algorithm. Anthonette D. Cantara, Angie M. Ceniza(2016)
3. Design and fabrication of smart band module for measurement of temperature and GSR (galvanic skin response) from human body.Dong-Sun Kima, Tae-Ho Hwanga, Jae Yong Songb, Sun Hwa Parkb, Jeanho Parkc,Eui-Sang Yooc, Nak-Kyu Leec, Joon-Shik Parka,(2016)
4. CogniMeter: EEG-based Emotion, Mental Workload and Stress Visual Monitoring.Xiyuan Hou, Yisi Liu, Olga Sourina and Wolfgang Mueller-Wittig (2015)
5. Emotion Monitor - Concept, Construction and Lessons Learned.Agnieszka Landowska (2015)
6. Design and Development of an Emotional Stress Indicator (ESI) Kit.Azian Azamimi Abdullah and Umida Hafsah Hassan (2012)

7. A Stress Sensor Based on Galvanic Skin Response (GSR) Controlled by ZigBee. María Viqueira Villarejo, Begoña García Zapirain and Amaia Méndez Zorrilla (2012)
8. Stress meter using skin resistance and muscle strength.Pranathi Kavuru K, Prannoy Koundinya Shilpa Aanbalagan. (2010)
9. Psychological acute stress measurement using a wireless adhesive biosensor Nandakumar Selvaraj. (2015)
10. Designing a Mobile Stress Management Application Encouraging Personal Reflection .Pedro Sanches2, Kristina Höök1, Elsa Vaara1, Claus Weymann, Markus Bylund2, Pedro Ferreira1, Nathalie Peira3, Marie Sjölinder2. (2010)
11. A Novel wearable sweat rate sensor for both dominant and recessive sweat rate measurement.Kunpeng. Gao1 , Xiaolin. Wang1 , Bing. Yang1 , Xiang. Chen1 , Xiuyan. Li1 and Jinquan. Liu1(2019)
12. Continuous measurement of sweating by electrical conductivity T. Togawa I, A.K.M. Shamsuddin 2, M. Nawata (2001)
13. Toward Evaluation of A Ship Navigator's Stress Based on Salivary Amylase Activity-Yui Matsuo,Laurie C.Stone, Koji Murai, Keiichi Fukushi and Yuji Hayashi(2009)
14. Multilingual sentiment analysis of personal correspondence. E. Tromp and M. Pechenizkiy. Senticorr(2011)
15. Designing a mobile stress management application encouraging personal reflection. P. Sanches, K. Ho ok, E. K. Vaara, C. Weymann, M.Bylund, P. Ferreira(2010)
16. Effects of stress on heart rate complexity-Acomparison between short-term and chronic stress.C.Schubert, M.Lambertz,R.A.Nelesen,W.Bardwell(2009)
17. Excessive heart rate increase during mild mental stress in preparation for exercise predicts sudden death in the general population . Xavier jouven,Peter J.Schwartz,Sylvie escolano(2009)
18. State anxiety and non linear dynamics of heart rate variability in students. Dimitriy A.dimitriv, Elena V.Sapeova, Aleksey D.dimitriev(2016)
19. Influence of mental stress on heart rate and heart rate variability. J.Taelman, S. Vandeput, A.Spaepen and S.Van huffel.(2009)
20. Stress detection using low cost heart rate sensors. Mario salai, Istvan vassanyi, and Istvan kosa.(2016)