European Journal of Molecular & Clinical Medicine
ISSN 2515-8260 Volume 07, Issue 11, 2020

A SURVEY ON STIMULATED STRESS THROUGH SMART SCREEN DEVICES USING BIG DATA ANALYTICS

E. Manjula[1 *], Dr. A. Prema[2]

[1]Research Scholar, Department of Computer Science, VISTAS, Pallavaram, Chennai.
[2]Associate Professor, Department of Computer Science, VISTAS, Pallavaram, Chennai.

Abstract:

Emerging growth of smart devices and application of smart screens in every consumer product enable the peoples to get compulsive interaction with the touch screen. Smart devices with flexible interactive option and evaluation of data analytics and machine learning keeps the humans get addicted with the devices day and night. Even though it offers us numerous advantages over time, Studies revealed that physiological changes are more prospected due to excessive interaction with the smart devices. Nowadays, human health history is ruined by technology in the form of endless connection with such device usage for long period which causes health issues like mental stress, behavior related problems. There are many sources to address stress in our routine life. Many studies have depicted the most impacted factors in smart devices. This paper focus on detailed study depicting the impacts of smart devices human body influenced by touch screen devices highly towards sense organs. Moreover, the biggest sense organ skin that acts as a communication medium for conducting such tiny electrical signals got affected a. Evaluation of big data analytics everywhere in medical industry to keep the patient information more secure and provides statistical view of such problem globally. Healthcare analytics has been changed into digital mode to keep patient's data most secure, less expensive, and easily accessible. Here, the problem begins with touch screen-based intervention in stress, including literature review in contrast with previous work in blood pressure and the proposed evaluation approaches.

Keywords : Stress analysis; Human Sense Organ; Touch Screen Mobile; Big Data Analytics in Healthcare; Machine learning; Smart screen impacts; PPG sensing.

1. Introduction:

A fast-growing non communicable disease: Stress, a biggest obstacle for healthy well-being among individuals of all age group at present. Stress and its symptoms are endless by nature and It is a physical response which depends how people react for situation. The intensity of stress can be modified in exceeding forms of individual's life changes; it could elastic our health at critical condition. According to health studies early detection of blood pressure reduce the risk factors from heart disease and other health complications including mental stress too. Unfortunately, on time measurement of long-term stress is difficult to oversee. To overcome these issues, nowadays we have increased number of hand-held devices to monitor stress levels, also assist physicians to access patient health history through online. Hence, on a daily basis information is shared exponentially between many types of electronic gadgets, and social media research activities to predict numerous patterns across users and the healthcare professionals and so forth.

As a result of this scenario, big data analytics in healthcare industry have been developed in the recent years across many countries. In general, healthcare data referred as highly unstructured way including text, image, video, and digital signals. Existing database management systems are insufficient to handle such a large amount of clinical big data. The reformation of primary data into meaningful information is daunting at times. Consequently, healthcare professionals and academic researchers taking their privilege to bring solution for this problem to care everyone needs.

2.Impact of Smart Devices:

Smart devices become commonly utilizable products nowadays to complete our daily task and improving the business, entertainment, and academics. The application of smart devices in all industries pushed us to interact with it throughout the day. As revealed in (XiaoZhang et al., 2018) [9], tapping the smart screens impacted the most on behavioral change and affect the thinking capability too. (Francesca et al., 2019) [5], Discussed about the impact of smart devices toward children's brain activity. The over exposure to the smart screens indirectly affects their thinking capability and response to the peoples interacting directly with them. The smart devices reduce the physical activity of the children and enable them to attract more with the content and colorful features. Hence the improved curiosity enables them to extend their time of usage and reduce the oral interactions. Hence the study [5] revealed that key factor for smart device impact is through sense organs. (Sara Thomae 2018) [4] The smart phone usage and frequency of usage have the connectivity that produce sleep disorders such as short duration of sleep, late night sleeps or no sleeps etc. The study revealed that the cause of depression and anxiety related to frequent usage of smart phones.

3. The gateway of Brain:

The sense organs act as the gateway of brain and other vital organs of the body. The brain creates the stimulus activity through the responses of short electrical pulses gathered from skin and other sensory organs. Skin act as a channel propagator that translates the tapping activity in the form of signals that runs throughout the body. Apart from skin ears that hear the smart phone notifications, eyes that visualizes the contents etc. The frequent usage of smart screens and relevant content search in internets enable the suggestions more quickly and apparently. The frequent response from the smart devices also affect the thinking cycle of the brain that affects the adults and children the most. Author Xiao Zhang et al., (2018) [9], analyze a lot on tapping signals and impacted brain activities through PPG data collected from various group of peoples. Nowadays, we have wide variety of compact medical devices to measure stress level including smartphone applications to detect instant stress level. Though, such devices induce stress where users tempted to make use of it. Author [1] discussed the effects of stress were measured during different activities performed over mobile interaction. Subsequently, in connection with long hours of usage in touch mode the degree of pressure is applied to the finger. So, the muscle is getting extracted which means tissues in finger exposed to high temperature.

3.1. The Role of Skin:

Kristina Grifantini (2016) [21], the skin is more sensitive and conductive to electrical signals during the consequent interaction with the smart phones. The study revealed that sudden increase in heartbeat, changes in normal cardiac activity impact the skin as an instant trigger that expose the skin to sweat. The skin becomes more conductive in nature. The skin expresses the change in

two forms. In the form of sweat and in the form of heat. The changes in skin temperature also an evident factor that convey the variations in normal activity of the body. The skin on the whole involves more in conducting such smart device miniature triggers. In many cases skin act as an individual channel to propagate such signals ref Fig 1.

4. Physiological Parameters:

Many research works depict about the physiological parameters that helpful for analyzing the human stress level due to exposure of smart devices.

Blood Pressure as Parameter:

Blood pressure acts as the vital role in measuring the brain activity and measuring the stress level in humans. Blood pressure raises and falls depends on the emotional state, anxiety, and hypertension. The frequent usage of smart devices allows the changes in blood pressure while undergoing sudden emotional change or state of reaction held with frequent usage of smart phone tapping, ((Cheng-Chun et al., (2019)) [11] .

PPG as parameter:

Photoplethysmography (PPG) is a non-invasive method of measuring the blood circulation monitoring in human body. PPG directly resembles the health status of cardiac systems. Any changes in PPG levels implies the troubles in cardiac system. Study concluded [2] (Yongbo et al., 2018), that relationship between PPG levels and human behavioral changes.

ECG as Parameter:

(SK-Saini et al., 2019) [3], The research work concluded that ECG impacts on stress level measurement in humans. The important aspect of ECG signals utilizes the intervals of peaks P,Q,R,S,T that produces every beat. Variation in heart rate, overviewed at the ECG data. The researcher concluded using the statistical analysis of ECG data comparing with the MIT-BIH arrhythmia database for standard references.

EEG as Parameter:

(GuoJun et al., 2016) [22], study revealed evident information on EEG data that are more useful for detecting the stress levels. The study focused on arithmetic test cases by conducting Color-word test, three levels of stress test, mental test through arithmetic logical questionnaires. The literature background provides confident step towards the stress level detection framework using physiological parameters.

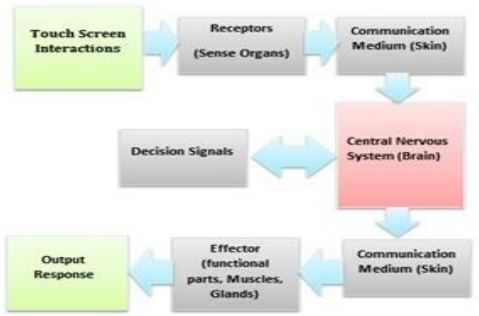

Fig 1: The Role of Skin

5. Literature Survey:

1. Xiao Zhang et al. (2018) [9], Study explored on Photoplethysmogram (PPG) based mental pressure estimated via infrared touchscreen. Investigation carried out using touchscreen monitors under touch and hold fashion to calculate person's mental stress. Support Vector Machine & Naïve Bayes techniques applied to enhance the precision. ANOVA test used in order to analyze the stress level. Person independent classifier has applied to predict whether person under stress or not.
2. ZhannaSarsenbayeva et al. (2019) [1], Investigated stress level by performing discrete task and its associated impacts during smartphone interaction. Individuals stress level instigated using Trier Social Stress Test (TSST) to assess its impacts while performing general task in smartphone. Also, changes measured before completing the task.
3. Youngjun Cho (2019) [16], Based on mobile thermal imaging, numerous physiological signatures were measured to construct a new model for a self-regulated mental pressure. In thermal based videos an object can be isolated by applying Visual motion-tracking algorithm which is a hardest problem of computer vision technique.
4. Christian Hessler and Mohamed Abouelenien (2018) [18], a contactless thermal imaging method utilized to extract numerous physiological signals from the human body to detect stress and behaviour pattern. Using segmentation algorithm and heat transfer model, a person's truthful response has been classified through modifications of blood flow ratio. Thermal Imaging technique helps to identify stress by monitoring transformation on face and also range of facial thermal designs generated due to various actions.
5. Cheng-Chun Chang et al. (2019) [11], Extraction of PPG signals using signal processing methods in a better way. Based on user's skin temperature wavelength can be predicted using MW-PPG detection technology. Maximal-ratio combining (MRC) algorithm followed to obtain strong PPG signals from MW-PPG signals. The precision of heartrate enhanced by qualified PPG signals which is extracted from quality wavelengths of MW-PPG detection technique.
6. NarushiNakane et al. (2019) [20], Explained the correlation between blood pressure (BP) change and dissemination of heat on facial skin. Cold pressor test (CPT) was utilized to raise Blood Pressure. Independent Component Analysis (ICA)- an efficient technique used to separate unique parameters in terms of Blood Pressure while person's face exposed under temperature.

6. Challenges In Smart Screen Impacts Analysis:

A countless assessment on mental stress, psychological emotion, mobile interaction stress to track health condition and so on. Sensors play significant role in the field of healthcare to monitor human health. At present, PPG sensor widely used in many applications, wearable devices to help people to measure Blood Pressure, Heart Rate to avoid risk in advance. Though, the factors of PPG signals become a challenging part which affect motion artifacts and further eliminates wavelengths required for. As observed in numerous literatures health issues in terms of stress, a range of techniques have been used to focus on health status to identify the problem. Also stated in many studies skin conductivity is a reliable indicator of stress. Consequently, blood pressure can be measured in finger and ear considered to be a right place in human body in order to receive sensitive signals from heart rate. However, stress under touch modality and its

consequences have not explored more. This paper explored previous studies about stress and its issues. Adding more interesting facts on the current discussion some more literature studies are tabulated below. The selective research papers help us to continue the flow of proposed research scope that manipulate the idea of stress level monitoring and detection system because of Touch screen devices through a number of hybrid algorithm creation ideas.

7.Interpretations On Solutions:

7.1 Role of Data Analytics:

Data analytics and big data handling were the key technologies enhance the research and analysis of Touch screen impacts on Human stress level in near future. The frequent usage of screen tapping, concurrent visiting of smart screens, mobile screen refresh rates, password swiping rate, slow tapping and random tapping were act as the information vectors that derives the hints on person using the touch screen. The positive translation of such activities enables many consumer product companies to improve the quality of service provided to the customers. Obviously, the negative impacts of such activity drain the health of the peoples with interaction. The primary data collected through such activity is further processed through robust data analytics models to improve the information grabbing quality of the system.

7.2 Role of Machine Learning Models:

The important aspect of touch screen analysis is developed with the help of numerous predictive algorithms. The predictive models contain the systematic training algorithms that use the measured features as primary data. The predictive models are tunable and user preferable in terms of selecting the feature vectors, preprocessing, and defining the performance duration, size etc. Neural network model such as Self-Organized mapping that is a type of artificial neural networks (ANN) which discretize the fast-flowing input data under test. Linear programming methods, regression analysis and concurrent networks are more helpful for implementing the human stress detection system with improved accuracy.

7.3 Role of Sensors:

Sensors act as the ingress channel to the edge computing models of human stress detection systems. Various sensors available in industry to sense the fast variant physical data from human body. The challenge of sensor is to apply the initial filters to reject the noise. Since human body is composed of so many sensitive organs, in which skin act as a translating medium for short electrical pulses. The variation in the human resistivity enable the sensor to detect the differences with the emitted signals from the objects. Here we represent the smart screen devices. The quality of sensor and the sensitivity level plays a higher role in acquiring the signals in a unique way with good noise rejection ratio.

8. Discussions:

The study work highlighted the important aspects of the touch screen impacted stress level detection system that provides us so many evident factors through literature reviews in Sec 5,6 etc. individual study on stress level detection parameters are clearly discussed in Sec 4. The feasible parameters are ECG, EEG, PPG, BP etc. Other than that, our proposed research work focused on tapping frequency, reducing noise in sensitivity of sensors, Visual impacts are being discussed Table 1. Clearly interprets the existing algorithms applicable for Smart screen induced stress detection. The literature review helpful for us to conclude the present study to innovate the idea

that is suggested to improve the existing methodology. From the above discussions, Sec 7, interprets the importance of Data analytics, machine learning in handling such sensory data.

TABLE 1
Literature Review On Various Implementations On Human Stress Analysis:

Sl	Research Topic	Authors & Year	Research	Algorith	Merits &
1	Cluster-Based Analysis for Personalized Stress Evaluation Using Physiological Signals[17]	Qianli Xu ; Tin Lay Nwe ; Cuntai Guan (2015)	Wearables inter subject analysis, Stress evaluation	K-Means Clusterin g	Merits:Inter-subject analysis Demerits:Large dataset processing challenges
2	Classification of stress into emotional, mental, physical and no stress using electroencephalogram signal analysis[8]	Adrian Emiell U. Berbano ; Hanz Niccole V. Pengson ; Cedric Gerard V. Razon ; Kristel Chloe G. Tungcul ; Seig (2017)	Emotional , Mental and physical stress	DWT, ANN	Merits: Analysis is accurate for small crowd; Demerits: increasing the dataset decrease the accuracy
3	Offline Lab View-based EEG Signals Analysis for Human Stress Monitoring[10]	NorizamSulaiman ; Beh See Ying ; Mahfuzah Mustafa ; MohdShawalJadin (2018)	Stress monitorin g window is developed	Cognitive State analysis	Merits: Live monitoring Demerits: Analysis accuracy is not focused
4	EEG based stress monitoring[23]	Xiyuan Hou ; Yisi Liu ; et al., (2015)	Stress monitorin g for air traffic controller s, real time applicatio n is developed	Support Vector Machine	Merits: Cognimeter for stress monitoring; Demerits Less number of subjects are influenced for testing
5	Human emotional stress analysis through time domain electromyogram features[12]	Bong Siao Zheng ; M Murugappan ; SazaliYaacob ; SubbulakshmiMurugappan (2013)	Different levels of emotions are detected	KNN, IIR, Notch filter, DWT	Merits: Positive emotions are captured Demerits: Negative emotions are classified as overview
6	Human Emotion Detection and Stress Analysis using EEG Signal [13]	Prashant Lahane, MythiliThirugnanam (2019)	Emotion analysis using DEAP dataset	KNN, TKEO, Neural Networks	Merits: TKE is apt for Simplicity and fast processing; Demerits: only two levels of emotions are detected
7	Emotions Recognition Using EEG Signals: A Survey[14]	S. M. Alarcão ; Manuel J. Fonseca (2019)	Neurophy sical measurem ent,	Survey is performe d	Merits: numerous algorithms are discussed; Demerits :Motion

			accurate EEG measurements		artifacts would be the major problem
8	Touch Sense: Touch screen based mental stress sense [9]	Xiao Zhang, YongqiangLyu, (2018)	Time domain and frequency domain , waveforms of PPG,	Support Vector Machine & Naïve Bayes	Merits: Efficient algorithm and accurate prediction; Demerits :Only Touch pads used
9	Measuring the Effects of Stress on Mobile Interaction [1]	ZhannaSarsenbayeva, Niels Van Berkel, Weiwei Jiang (2019)	High frequency of HRV, throughput and accuracy of task finishing time.	FFT	Merits: Mobile interaction are considered for predicionDemerits:Noisy Data and performance is low
10	Automated Mental Stress Recognition through Mobile Thermal Imaging [16]	Youngjun Cho (2017)	Respiration and blood volume pulse	Thermal Gradient Flow and Thermal Voxel Integration algorithms	Merits: Single sensor prediction system; Demerits :Long measuring time
11	Smartphone-Based Blood Pressure Measurement Using Transdermal Optical Imaging Technology [15]	Hong Luo, Deye Yang, Andrew Barszczyk (2019)	Systolic, Diastolic, and Blood Pressure	Machine learning	Merits: Improved measuring parameters, Accuracy is good; Demerits :Motion artifacts would be problem[
12	Photoplethysclusterbased mography and Deep Learning: Enhancing Hypertension Risk Stratification [2]	Yongbo Liang, Zhencheng Chen (2018)	Blood pressure level	Deep learning	Merits: Uniqueness prsent in PPG is obtained, Accuracy is good; Demerits :more phchological issues are not considered

9. Conclusion:

Smart devices fasten the world and in the same way produces drawback that should be noted in early impact. Stresses become a common problem in all levels of individuals that grows up slowly and ruin the human life by providing various health issues indirectly. Finally, it is necessary to observe individual health condition with respect to stress. Studies explored that stress become an important issue among all generations. Apart from clinical services self-diagnosis is a simple way for everyone to keep track of risk factors to avoid organ attack. From

the proposed study it is being revealed that touch screen-based stress level needs to be monitored. The evaluation of machine learning algorithms and Data analytics emergence enable us to focus our view on innovating a hybrid robust methodology that should incorporate the technology challenge as well focus on noise rejection etc. The study is extended to further implementation using the Hybrid combination of Data analytics and Machine learning algorithms with acquiring large set of datasets through volunteers. The analysis also focused to segregate with respect to age, profession, mental and health status.

References:

[1] Z.Sarsenbayevaa et al., (2019), "Measuring the Effects of Stress on Mobile Interaction.,." IMWUT Jnl.2019
[2] (Liang, Yongbo et al., "Photoplethysmography and Deep Learning: Enhancing Hypertension Risk analysis." BS journal(2018).
[3] (Saini et al.,(2019)), "A study - ECG Signal Analysis for Mental Stress," 2019 Int. Conf. on CSD, New Delhi, India.
[4] Sara Thomée (2019)), Univ. of Gothenburg., MDPI, Research Topic on Review of Mobile phone use and mental health (2019).
[5] S. Kumar and M. Singh, "Big data analytics for healthcare industry: impact, applications, and tools," in Big Data Mining and Analytics, vol. 2, no. 1, pp. 48-57, March 2019.
[6] Alexander, C. A., & Wang, L. (2017). ".,Big-Data-Analytics in Identification, American Journal (2017).,
[7] Ismail, Ahmed &Shehab, Abdulaziz& El-henawy, Ibrahim. (2019). Healthcare Analysis in Smart Big Data Analytics: (Reviews, Challenges) published year 2019.,
[8] (A. E. U. Berbano, et al.,, "Classification of stress into emotional, mental, physical and no stress using electroencephalogram signal analysis," (2017) IEEE Int. Conf. on Signal and Image Processing 2017.,
[9] Xiao, Zhang &Lyu, Yongqiang& Luo, Xiaomin& Zhang, Jingyu& Yu, Chun & Yin, Hao& Shi, Yuanchun. (2018). Touch Sense: Touch Screen Based Mental Stress Sense. Proceedings of the Interactive, Mobile,
[10] N. Sulaiman, et al., "Title on Offline LabView-based EEG Signals Analysis for Human Stress Monitoring," 2018 9th (ICSGRC), Shah Alam, Malaysia, 2018,
[11] Chang, Cheng-Chun & Wu, Chien-Ta & Choi, Byung -& Fang, Tong-Jing. (2019). MW-PPG Sensor: ".An on-Chip Spectrometer Approach. Sensors.," 2019 published.
[12] Bong Siao- Zheng ; M-Murugappan ; -Sazali -Yaacob ; SubbulakshmiMurugappan.,, "..Human emotional stress analysis through time-domain-Emg features.," 2013 Industrial Applications IEEE symp. 2013,
[13] Lahane, *Prashant ; MythiliThirugnaanam., "analysis of Emotion & Stress analysis.utilizing brain signals (2019).
[14] S. M. Alarcão and Fonseeca, "A Review : ..Emotion Classification(EEG) Signals.,: A Survey Paper," IEEE Trans. on Affective-Computing, Sep 2019 published.
[15] Luo, H., Yang, D., Barszczyk, A., Vempala, N., Wei, J., Wu, S. J., Zheng, P. P., Fu, G., Lee, K., & Feng, Z. P. (2019). ",Smartphone-Based Blood Pressure Measurement-Transdermal-Optical .Imaging Technology.(2019)
[16] ' Y. Cho, "Automated-mental stress recognition -mobile thermal imaging," 2017 ACII- int.Conf. Proceeding Year 2017.

[17] Q. Xu, T. L. Nwe and C. Guan, ".,Cluster-Based Analysis - Personalized Stress Evaluation - PhysioSignals," in IEEE – BioMedical Journal 2015.,

[18] C. Hessler and M. Abouelenien, "Through Thermal Images and Physio Features to Model Human Behavior: A review paper," 2018 IEEE Conf.on multimedia info. 2018.

[19] A..,Maxhuni Pablo Hernandez-Leal.. c,d, (L.EnriqueSucar c, Venet-Osmani b, .Eduardo F. - Morales c, Oscar -Mayora ".Stress-modelling & prediction in presence.,". 2016 Elsevier ., Biomedical-Infomatics.,

[20] Nakane, .Narushi& -Oiwa, Kosuke & Nozawa, Akio. (2019). Relationship between mechanisms of blood pressure change & facial skin temperature distribution. ALR (2019).

[21] K. Griifantiini 2016., "Research on Skin-Conductance* & Brainwave., pub.., 2016 proceedings..

[22] GuoJun , K. G. Smitha.,(2016) Stress Level Identification – EEG "., IEEE Int. Conf on cybernetics 2016

[23] Hoou, Xiyuaan& (Liu, Yisi&Sourinaa, (Olga &Eilen, -Tann&Wangg, -Lipo&Muiller-Wittigu, -Wolfgangg). (2015). "EEG for Stress Monitoring(Paper IEEE). Published Year(2015).