STRESS DETECTION AND REDUCTION USING BINAURAL WAVES

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ABSTRACT

The negative effects of mental stress on human health has been known for decades. High-level stress must be detected at early stages to prevent these negative effects After the emergence of wearable devices that could be part of our lives, researchers have started detecting extreme stress of individuals with them during daily routines .We developed an automatic stress detection system using physiological signals obtained from unobtrusive smart wearable devices which can be carried during the daily life routines of individuals. Stress can trigger ill mental health or, at any rate, poor mental health, which places psychological stress on the body. It is estimated that 60% of doctors' appointments are triggered by stress-related symptoms.

Keywords-Stress, Galvanic skin response,Binaural waves,Noemcu,Arduino.

I. INTRODUCTION

Stress, better explained in , is a response to particular events. It is the way our body prepares itself to face a difficult situation with focus, strength and heightened alertness. 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.In our method we use pulse oximeter and galvanic skin response to detect stress,when the user is in stress the pulse rate and skin conductance is monitored and at the critical stage a message to the registered mobile number and after the pre-stored binaural waves can played automatically,the user can hear it through headphones.

II. LITERATURE REVIEW

[1]Although psychologists studied emotions since the 19th century, there is still no consensus on a universally accepted definition of what emotions are and how they are generated. However, over a century of research clearly shows that emotions and bodily functions are related. For this reason, many studies in the psychophysiology literature employ physiological data such as electrodermal, cardiovascular and muscular activity to measure participants' affective states including those related to stress. Other instruments such asquestionnaires and

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scales could be used as well to assess an individual's affective state. However, they cannot be administered to users without interrupting the task they are carrying out and thus affecting the users' emotions. Furthermore, in addition to the possible biases that can affect answers to any type of questionnaire, the intrinsic ambiguity in describing emotions through written words could undermine the reliability of such instruments in emotion assessment. Therefore, the development of systems that allow for stress detection through physiology is a particularly appealing direction, and not just for experimental studies. Indeed, such systems could have many possible real-world applications.

[2] The automated detection of stress is a central problem for ambient assisted living solutions. The paper presents the concepts and results of two studies targeted at stress detection with a low cost heart rate sensor, a chest belt. In the device validation study (n = 5), we compared heart rate data and other features from the belt to those measured by a gold standard device to assess the reliability of the sensor. With simple synchronization and data cleaning algorithm, we were able to select highly (>97%) correlated, low average error (2.2%) data segments of considerable length from the chest data for further processing. The protocol for the clinical study (n = 46) included a relax phase followed by a phase with provoked mental stress, 10 minutes each. We developed a simple method for the detection of the stress using only three time-domain features of the heart rate signal. The method produced accuracy of 74.6%, sensitivity of 75.0%, and specificity of 74.2%, which is impressive compared to the performance of two state-of-the-art methods run on the same data. Since the proposed method uses only time-domain features, it can be efficiently implemented on mobile devices.

[3]Applying modern computer vision technologies for enhancing safety of vehicle driving has been investigated for several decades. Most of the research focused on detecting drowsiness of the driver, causes a large percentage of the car accidents. Recently, reports also show that the emotional status (e.g. stress, impatience) of the driver may as well endanger the safety. From the viewpoint of behaviour scientists, high level stress may damage self-confidence, narrow attention and eventually disrupt concentration. This often leads to aggressive driving and makes the driver pay less attention to the traffic situation. To reduce riskiness from a stressed state, it is necessary to detect such emotions and take certain actions to relax the driver. Most of the previous work on stress detection applies physiological features (such as electromyogram, electrocardiogram, respiration, and skin conductance). It is found that in real-world driving tasks, skin conductivity and heart rate metrics are most closely correlated with driver stress level. However, those measurements are intrusive, so are less comfortable in real applications. A non-intrusive stress detection system is developed in which a physiological measure based on skin temperature is used. In acoustic signals are used for measuring the stress level. However, the performance might be affected by the noisy in-car driving. . A system fuses several physiological signals and visual features (eye closure, head movement) to monitor driver drowsiness and stress in a driving simulator. Liao et applies facial expression, head motion and eye gaze as the visual cues for stress inference and evidences of the different signal modalities are combined with Dynamic Bayesian Networks (DBN). The camera is mounted inside the dashboard facing the driver.

[4]Excessive psychological stress, one of the major mental health problems of modern society is related to many negative mental and physical health outcomes, for example, anxiety, depression disorders, heart disease, cancer, and infectious illnesses.Evidence from psychiatry research also showed mental stress as one of the most significant prenatal risk factors of Tourette's syndrome (TS) and attention deficit and

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hyperactivity disorder (ADHD). Breast cancer research showed improvement brought by stress management in cellular immune function,Quantitative stress assessment, therefore, has great potential uses in various types of mental healthcare for both mass and specific population.Heart rate variability (HRV) is known as a psychological stress indicator. Consensus that multiple measures of HRV have consistent changing trends during the onset of stress was reported.In previous studies of mental stress detection; measures of mean of heart rates (mHRs); standard deviation of beat-to-beat interval (SDNN); root mean square of the sum of the squared differences between adjacent normal R-R intervals (RMSSD); very low-, low-, and high-frequency ranges in power spectrum (VLF, LF, and HF); and pNN50 were employed. Good prediction accuracies of machine learning were seen in published studies.However, several challenges still exist in application of the stress-detection technology. One of the major challenges of stress detection with machine learning is the realism of the prediction result. Subjective stress is considered continuous in value domain and can be measured with self-report scales with fine granularity.

[5]R.S Lazarus and S. Folkman proposed a paper, that explains about the stress, appraisal and coping.[6]Assessing Knowledge retention of an immersive serious game vs Traditional education method implementing stress.[7]Stress detection using physiological sensors that detect the physiological values of the person and detect stress.[8] Detecting the emotional stress using facial expression using for drivers by using camera and artificial intelligence. [9]A core based approach using behavioural biometrics of the person.[10]A real time based approach for detection of stress using EEG Signals that can detect stress using EEG waves from head electrode.

Here with reference to all these papers we have come across with an idea,we created our idea with GSR and pulse oximeter that can detect the pulse rate values and Skin conductance of the user skin and the values can be used to detect the users condition.If the values crossed the normal range then the alert message send through IoT platform.

III. METHODOLOGY

Our project uses pulse oximeter and Galvanic skin response when the pulse oximeter reading crossed above 100 and the values of the galvanic sensor value decreased from 1024 then the both readings passed to the Arduino UNO and the values displayed in the LCD display. After that the Arduino sends signals to the NodeMCU,it acts as a Wi-Fi-module and the internet connection provided by the user's mobile. Then the alert message send to the user's family and for reduction of stress the system contains a microSD module that have pre stored binaural waves which are used to reduce stress and anxiety,The user can hear the waves by using headphones and the music can be stopped by pressing stop button.

The block diagram explains how the system works.

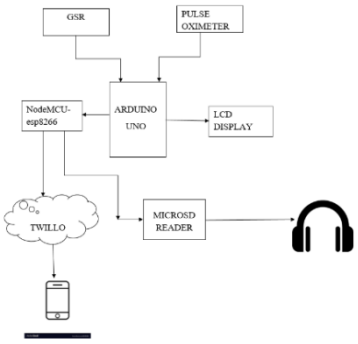

Figure 1:Block diagram of the system.

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The flowchart of the system is given below

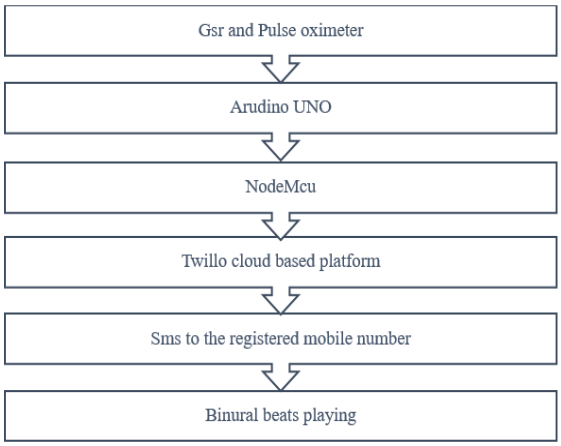
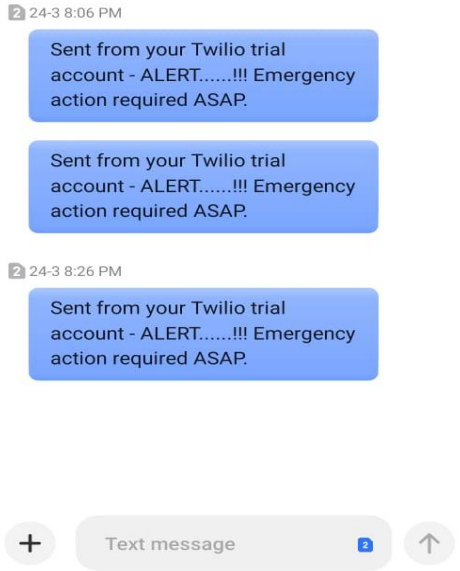


Figure 2: Flowchart of the system

The flow chart shows that the inputs from the GSR and Pulse oximeter then the data is processed then the micro controller unit sends signals to the Nodemcu and then through twillo a web based messaging platform,the alert message for the registered mobile number by the user to alert their family.

IV. OUTPUT



The output is the message forregistered mobile number send through the web based platform.

V. CONCLUSION

This paper presents a new concept of stress detection and reduction using binaural waves designed to reduce significant amount of stress for the people who suffered from periodic duration of stress in their regular life.Stress can impact mental health as well as physical health so that we have to take care of stress levels in the modern life style.The system capability, however can be easily extended to multiple tasks by adding models to the program. The system design, working mechanism and principle were discussed along with some experiment results. This new concept is expected to improve the lifestyle of peoples lives in modern tight schedules. Our immediate future work includes assessing the user-friendly and optimizing the computing unit. Technology plays a very important role in our life. We use it almost everywhere and every time. The distinct and quick development that we discover each day proof for us that there is no point to give up and struggle with our obstacles in life. Technology offers us a lot of significant solutions to our problems. Our role is to use it properly to reach the success level that benefits individual society and whole country as well.

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