Recent Advances in Technology and Engineering (RATE-2017)
6th National Conference by TJIT, Bangalore

International Journal of Science, Engineering and Technology
An Open Access Journal

Stress Detection and Management using M-Health System

[1]Monica Sneha, [2]Nandhini M, [3]Prof Ashwini Patil

Abstract

This paper proposes an M-health (mobile health) system for stress detection and management. The M-health system involves an accelerometer, which is inbuilt in a smart phone, a wrist sensor and a smart phone application. The accelerometer is used to detect stress and when stress is detected the wrist sensor/tracker is used to keep track of the individual's state. The smart phone app is used to help the individual to cope up with stress.

Keywords: Stress detection, Stress management, Accelerometer, GSR sensor.

Introduction

As the saying goes "It's not stress that kills us, it is our reaction to it", hence it is necessary to act positively towards stress. The M-health system aims to motivate a stressed individual to continue with their basic daily activities. The system also aims not to make the individual completely dependent on the wrist sensor /tracker. The data collected by the sensor is backed-up to a database for further study.

The existing systems for stress detection and management involves Smartphone applications and wrist sensors. The applications usually employ a questionnaire to identify if the individual is stressed. The individuals may often ignore the questions when stressed. Many applications also recommend new relaxing activities for the stressed ,but when stressed people often tend ignore their basic activities hence less chances of them doing something new. The wrist sensor requires the individual to constantly wear the wrist band. But the individuals may not be comfortable doing so.

The proposed M-heath system aims to detect stress using the accelerometer, which is inbuilt in the Smartphone. When the person is identified to be stressed, the Smartphone app prompts them to wear the wrist band. The wrist band consists of a GSR sensor that detects and tracks the stress levels of the individual. While the stress levels are being monitored, the app motivates the individuals to perform their basic activities such as a walk that he/she may take every day, but is skipped as he/she is stressed.

The m-health system aims to detect stress at acute stages and help the individual in fitness management during the stressed period by motivating him rather than being unpleasant dictators. The system uses a Human Centred approach for stress management.

PROPOSED SYSTEM

The M-health system consists of a GSR sensor, a Smartphone app and also uses an accelerometer.

1. Accelerometer

Accelerometer is used to analyze the tilt of the Smartphone. It detects the change in orientation of the phone and used in video games, screen rotation etc.

This accelerometer is used to detect stress in the user. The Memsic accelerometer block diagram (2.1.1) is as follows:

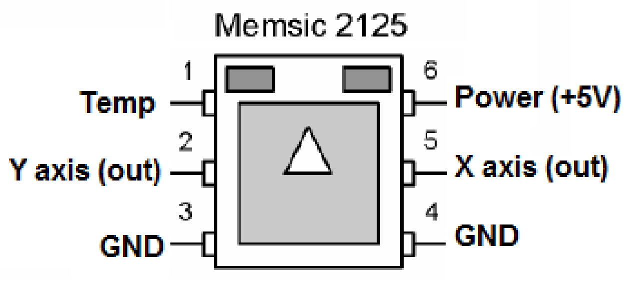

Fig 2.1.1: Memsic 2125 diagram

The accelerometer is used to obtain the behavioural data from the user. The raw data from the accelerometer is processed to extract the stress state data using an algorithm. Based on the data extracted, the stress state is evaluated on a scale of five. If the stress scale is detected at or above three then the individual is detected to be stressed. Stress states below three denote an anxious state of the user. The below Fig (2.1.2) illustrates the accelerometer-Smart phone working

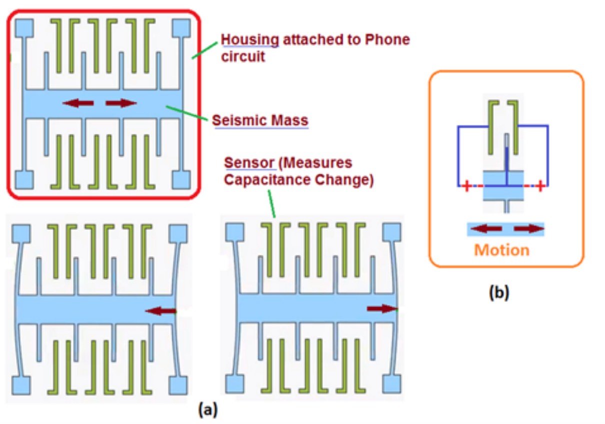

FIG 2.1.2: Accelerometer-smart phone working

Smartphone application

The app works based on a human centred approach where in the user is motivated to carry his/her basic activities. At the time of sign-up, the user personal details and the basic physical activities that he /she performs on a daily basis along with the time when they perform it, is listed out. When stressed, the app reminds the user about:

- Water intake
- Nutrition intake
- Regular physical activity

The app works by giving reminders regarding water and food intake during regular intervals, thus urging them to maintain fitness. The app also gives reminders to the user about the physical activity that he/she carries out, at the time mentioned during sign-up. The user may accept the reminder or may choose to snooze it off to another time when he/she wishes to perform the activity.

The snooze off feature of the app aims to be a pleasant reminder to the user, rather than a dictator. The user is free to remove the sensor band when their stress levels are back to normal, thus not making the user a slave to technology. Fig 2.21 illustrates the working of the app.

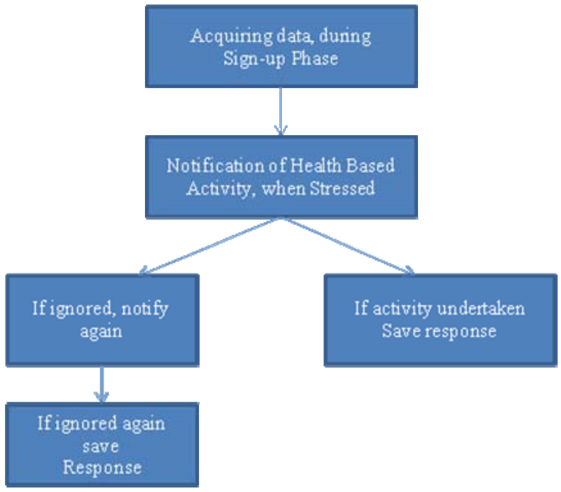

Chart 2.21: Workflow of the App

Wrist sensor

When an individual is stressed the electrical characteristics of their skin constantly changes. This is called electro dermal activity or galvanic skin response. One of the best ways to detect stress is using a Galvanic skin response sensor (GSR sensor).

The wrist sensor uses a GSR circuit to detect and track stress. FIG 2.31 shows the GSR circuit and a microcontroller.

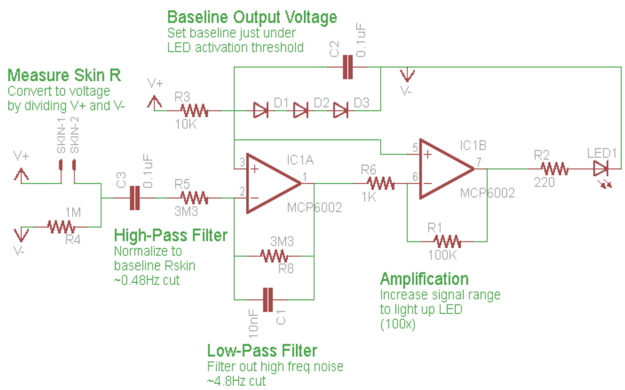

Fig 2.31

The GSR functions at 5v and the resistor values in ohms are as follows: R1=100k, R2=220, R31=0K, R4=1M, R5=1K, R6=1K.

The analogous signals obtained from the GSR are interpreted by the microcontroller. This data is used to track stress levels of the user. The data from the wrist sensor is used by the app to monitor and manage stress. This data is also backed up to a database for further analysis of stress patterns in humans.

System Comparison

Since accelerometer is used for stress detection, the user need not put on the wrist sensor throughout. Most of the apps which are prevailing in Market these days have become unpleasant commanders, making individuals slaves to it. This app uses a Human centred approach and helps users to cope up with stress rather than pressurizing them more.

GSR is used in detection/tracking as it is the most sensitive measures for emotional arousals or emotional sweating, as it originates from autonomic activation of sweat glands in the skin.

Acknowledgement

We would like to express our greatest gratitude to TJIT, HOD of Department of Computer Science. We would also like the say thank you Prof.Sejal and Prof.Ashwini Patil for the abundant support and guidance during the making of this paper.

References

[1] Saad Almesalm, Lucas Stephane and Guy Boy (2017). Helping College Students to Manage Stress: A Human Centered Smartphone Application for Stress Relief. 150 West University Blvd, Melbourne, FL 32901, USA.

[2] Maria Villarejo, Begona Garcia Zapirain and Amaia Mendez Zorrilla (2012).A Stress Sensor Based on Galvanic Skin Response Controlled by Zigbee. Deusto Institute of Technology, University of Deusto, Avda de las Universidades 24, Bilbao 48007.

[3] Akram Bayat, Marc Pomplun, Duc A Tran. A Study of Human Activity Recognition using Accelerometer info from Smartphone. Department of computer science, University of Massachusetts, Boston, 100 Morrissey Blvd Boston, MA 02125, USA.

[4] Hindra Kurniawan, Alexander V Maslov, Mykola Pechenizkiy. Stress detection from speech and GSR signals. Department of computer science, TU Eindhoven, the Netherlands.

[5] Akane Sano, Rosalind W. Picard (2013). Stress Recognition using Wearable Sensor and Mobile Phones. Massachusetts Institute of Technology MA, USA.

[6] Akram Bayat, Marc Pomplun, Duc A Tran (2014).A Study on Human Activity Recognition using Accelerometer Data from smartphone. Department of computer science, University of Massachusetts, Boston, 100 Morrissey Blvd Boston, MA 02125, USA.

[7] E. Garcia-Ceja, V. Osamni, O. Mayora(2015). Automatic Stress Detection in Working Environments from Smartphones' Accelerometer Data: A First Step. International Research Centre, Trento, Italy.

[8] Tong Boon Tang, Lip Wee Yeo, Dandy Jing Hui Lau (2014).Activity Awareness can Improve Continuous Stress Detection in Galvanic Skin Response. Electrical and Electronic Engineering Department Universtiti Teknologo PETRONAS 31750 Tronoh, Perak, Malaysia.

[9] Richard P Troiano, James J McClain, Robert J Brychta, Kong Y Chen (2014). Evolution of accelerometer methods for physical activity research.9609 Medical Centre Dr, MSC 9762, Bethesda, MD 20892-9762, USA.

Author's details

1.Monica Sneha, Student, Department of Computer Science Engineering, T.John Institute of Technology, Karnataka, India, monicasneha47@gmail.com

2.Nandhini M, Student, Department of Computer Science Engineering, T.John Institute of Technology, Karnataka, India, nandhinimagi46@gmail.com

3. Prof.Ashwini S Patil Department of Computer Science Engineering, T.John Institute of Technology, Karnataka, India, ashwinipatil@tjohngroup.com