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Stress Detection using Arduino

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Abstract - *Stress detector, is a system that measures stress level of a human being who is known to be under stress. This method has the potential to be precise and smoother. Stress brings negative consequences such as decreases in level of concentration, mental health issues such as anxiety and depression as well as ineffective ways of coping, such as substance abuse. In the market, there are smart phone's apps where people can hold a finger to the camera, which will then detect slight changes in color related to blood flow. If a person is able to recognize when they get stress and what they get stress from, it will be helpful for them to find ways to relieve it. It is our intention to address these gaps in the market and create a system that will be beneficial to a great many patients and health care practitioners by better assisting them by taking control of an elevated physiological response that has many negative health consequences. Through this project we aim to understand the various conditions that lead to stress, find suitable parameters to measure and detect it using arduino and then immediately present it to the user through an android app. This project describes our efforts and results in answering these questions. The most popular physiological markers of stress are as follows: Galvanic skin response (GSR); Electromyogram (EMG); Skin temperature; ECG; HRV.*

***Key Words*: stress, IoT, Sensors, Arduino, mental health, blood flow, Galvanic Skin Response, Electromyogram, Skin temperature**

1. INTRODUCTION

Stress is commonly defined as a feeling of strain and pressure. There is evidence that stress is linked with many diseases, playing a crucial role in the development of cardiovascular diseases , diabetes , or asthma , and it also significantly influences the later course of these diseases. Stress is related to lifestyle; therefore, especially for mobile automated lifestyle counseling and analysis services, the need arises to identify stress automatically during daytime, using physiological data from various sensors. If stress could be reliably and automatically identified, this could directly help users manage stress situations, and it could also be used in medical intelligence applications, for example, in refining blood glucose predictions for diabetics during daytime under influence of stress. However, the available methods for automated stress detection based on low price, ubiquitous sensors, are yet immature. Telemonitoring and self-management systems extend the horizons of traditional health care using only point of care measurement data, but the proper interpretation and reliability of the results depend on the reliability of the measured data and the sensor itself. The two crucial questions related to this problem are as follows: (i) whether low price physiological sensors are reliable enough compared to "gold standard" devices accepted by and used in clinical practice. (ii) Which sensors and algorithms can provide a reliable method for stress detection, at an affordable price and minimal user interaction.

2. SURVEY OF EXISTING SYSTEM

2.1 Stress Detection in Working People[1]

This paper corroborates how to select dominant features and fuse overlapping technique to extract the features from physiological sensors under conditions of work stress and context recognition to determine the stress in working individuals. It is evident from the classification results that the time and frequency domain features of HR, HRV, and GSR are sufficient to predict the stress. A hardware model for stress detector can be realized with the chosen features and the simulated model in an appropriate platform which results in a complete stress detector device.

2.2 Stress Detection Using Low Cost Heart Rate Sensors[2]

From this research paper it is learnt that even a simple low cost heart rate monitor device can detect features that change significantly under the influence of mental stress. Using these results we created a simple stress detection algorithm that is being integrated in the Lavinia lifestyle counseling mobile application for further testing and refinement in real-life stress situations. If stress detection proves to be reliable for larger samples, it will be used in the blood glucose prediction models developed for diabetics.

2.3 Stress Detection Using Physiological Sensors[3]

In this paper we see that electrodermal activity (EDA) sensors measure changes in the electrical conductivity of the skin surface. Changes in EDA can be produced by various physical and emotional stimuli that trigger variations in sweat-gland activity. Unlike other bodily functions, EDA is controlled exclusively by the SNS, making it an ideal physiological signal for stress measurement. Moreover, current EDA sensors are unobtrusive and allow for reliable signal recordings. Cardiovascular system activity can be measured through various physiological signals. In the computer science literature, blood volume pulse (BVP) and electrocardiography (ECG) are the most frequently employed signals. BVP is related to the amount of blood flowing into the peripheral vessels, such as those in fingers or earlobes, and is generally measured through a photoplethysmograph (PPG).

3. IMPLEMENTATION PLAN

3.1 Block Diagram

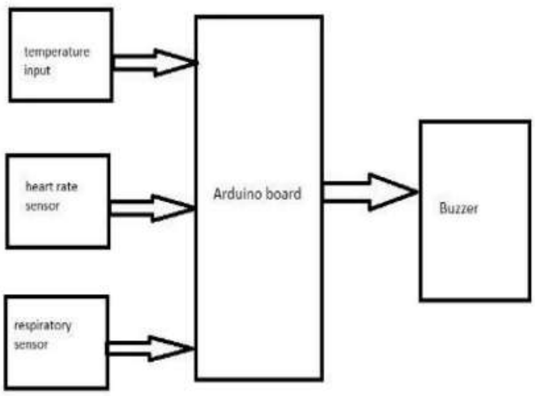

Fig -1: Block Diagram

3.2 Details of hardware and software

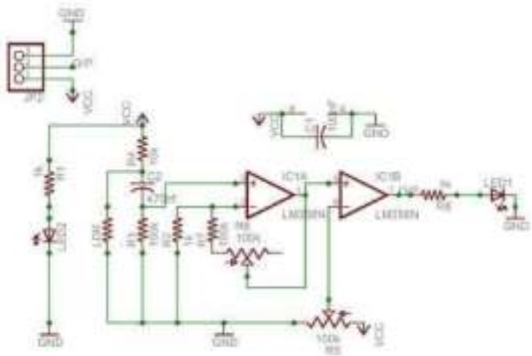

Fig -2: Heart Rate Sensor

For the transmittance heart rate sensor a light source is emitted in to the tissue and a light detector is placed in the opposite side of the tissue to measure the resultant light. Because of the limited penetration depth of the light through organ tissue the transmittance heart rate sensor is applicable to a restricted body part such as the finger or the ear lobe. However in the reflectance heart rate sensor the light source and the light detector are both placed on the same side of a body part. The light is emitted into the tissue and the reflected light is measured by the detector. As the light doesn't have to penetrate the body the reflectance heart rate sensor can be applied to any parts of human body. In either case the detected light reflected from or transmitted through the body part will fluctuate according to the pulsatile blood flow caused by the beating of the heart.

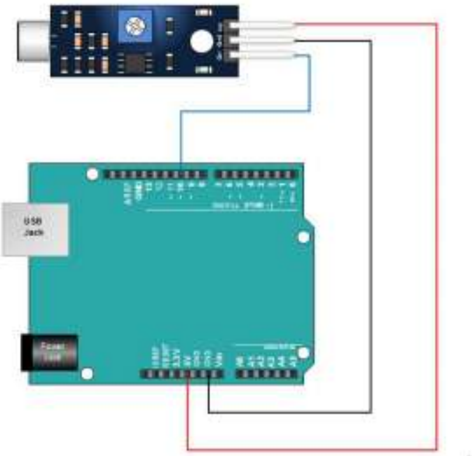

Fig -3: Heart Rate Sensor

This module allows you to detect when sound has exceeded a set point you select. Sound is detected via a microphone and fed into an LM393 op amp. The sound level set point is adjusted via an on board potentiometer. When the sound level exceeds the set point, an LED on the module is illuminated and the output is sent low.

Fig -4: Body temperature sensor

LM-35 is a Humidity and Temperature Sensor, which generates calibrated digital output. LM-35 can be interface with any microcontroller like Arduino, Raspberry Pi, etc. and get instantaneous results. LM-35 is a low cost humidity and temperature sensor which provides high reliability and long term stability. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and outputs a digital signal on the data pin (no analog input pins needed). Its very simple to use, and libraries and sample codes are available for Arduino and Raspberry Pi.

4. RESULTS

Fig -5: Serial Monitor Result

5. CONCLUSIONS

Research was done to decide the best physiological signals to use in stress detection, how these signals can be detected, how these signals are affected by stress and what would be the best model or system to use in stress detection. Data were gathered to present the appropriate physiological signals to be considered as inputs to the algorithm. The sensors were validated in order to confirm that they could accurately detect the physiological signals. The algorithm was then developed to determine the level of stress. Physiological signals served as inputs to the algorithm. The signals were fuzzified and passed through the inference engine before they were defuzzified to produce an output that corresponds with a level of stress. The algorithm was then tested and evaluated to prove the efficiency and capability of the system; it was statistically proven that the system can accurately detect stress level. The system can be used to increase awareness of stress among mouse users which can help them better manage their stress levels and do what is needed to improve their performance.

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