Design and Implementation of Human Stress Detection System: especially for Autistic children

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Abstract - Stress can be recognized as a normal feeling when it is in its limit. If it sustains for more days it will surely lead to a number of diseases. A person should learn to handle stress in order that doesn’t affect him as well as his surroundings. Many people don’t realize the occurrence and reason of stress. The working condition of some people never gives any option of thinking mental strength (i.e., stress management). Children who are referred to be autistic will not be able to express their internal feelings which also reduce their confidence level. Hence a system which monitors, detects, and analyses the health parameters will really help as a supplement care taking unit. It consists of a pulse sensor, temperature and skin resistance detecting circuit. The former sensor detects the heart beat rate and temperature of the human body which helps in the stress detection. Skin resistance circuit makes use of skin property namely galvanic skin response to detect the stress levels. These sensor detected values were used to manipulate the stress level. The ThingSpeak cloud is accessed to store the data obtained. The data can be sent to the user through email automatically after the prescribed time. This report can be used for stress management and also for treatment purpose. The person will definitely realize the importance of stress management and hence the concerned person will have a look on the report.

Introduction
Stress is a normal reactive response of a human body. It occurs naturally and also sublimes the same. But nowadays people don’t allow the stress to go off or the situations hold the stress tighter. Because of the persisting stress levels, people face as many as health issues. Autistic children, who can’t even explain their normal feelings and burst out many times, because of inexpressive and unwilling situations, a survey speaks. As of now, stress is also one of the disasters of the decade. Hence this paper
concentrates on the detection of stress with some of the psycho physiological parameters. Mind reacts and shows some physical signs which can be predictive as a relative symptom. This property of the human body can be utilized for the detection of stress and data obtained have been correlated to indicate the user how strong he/she should concentrate on stress management.

**Block Diagram**

![Block Diagram of Stress Detection System](image)

Figure 1. This figure represents the block diagram of the stress detection system. The block diagram consists of controller, sensors and wi-fi module which sense, process the data and store it in the cloud to send the required data to the user.

**Methodology**

Sensors and transducers were known to be the greatest correlated invention which makes an authentic relationship between environment and prediction. Sensors and Transducers were used to sense and...
convert the physical quantity into an equivalent electrical quantity. The same helps in our project to detect the stress. Stress will be relatively expressed through heart rate, blood flow, temperature regulation and skin resistance variation. Heart rate and blood flow can be detected by the pulse sensor which in turn sends the analog voltage signal as an input to the processor. Temperature can be detected by the temperature sensor which detects ambient temperature and sends the analog voltage signal as an input to the processor.

Skin resistance variations can be found by using the sensor designed. It can be called as skin resistance detector. It utilizes the property of the skin named as galvanic skin response to detect the skin resistance variations. According to the studies based on the electro dermal activity, the skin resistance raises when we are in a relaxed condition and the skin resistance drops when we are in a stressful condition. The skin resistance is monitored and by then the skin resistance variations are converted into voltage signal and fed into the processor. These analog signals/values have been taken into account to calculate the intensity of stress. The standard values of resistance, temperature and heart beat rate were known. With the help of the data, the occurrence of stress will be noticed and stored in the cloud storage. The user can access the data through login ID created. The data can be accessed through the e-mail ID where we will be availed with a precise report of the day’s experience.

**Circuit diagram**

![Circuit Diagram](image-url)
Figure 2. This figure represents the circuit diagram of the stress detection system. It demonstrates the hardware setup of the system.

![Circuit Diagram](image)

Figure 3. This figure represents the skin resistance detection circuit which detects the voltage drop across the skin resistance. The voltage drop across the skin resistance have been considered to be the indicator of the galvanic skin response, a psychophysiological parameter.

**Description**

Pulse sensor has three pins namely Vin, GND and Signal. Pulse sensor has two surfaces. One is for Light Emitted Diode and light sensor and the other side is the circuit for cancelling noise and amplifying the obtained signal. The Light Emitting Diode located on vein emits light to check the blood flow and so the heart rate is also calculated. During the blood flow through the vein, the sensor will receive more light. This change in the light received will be examined to decide our pulse rate.

LM35 has three pins namely Vin, GND and Output. Temperature sensors works based on the property that pure metals change their resistivity with respect to the temperature. These sensors measure the amount of heat in a system which allows detecting the change in temperature producing an equivalent electrical output. Skin resistance sensor have been designed using an operational amplifier IC 741. A Non inverting amplifier configuration is used to detect the change in the voltage drop which is an indicator of the galvanic skin response. With the help of voltage drop detection, the variations in the skin resistance can be noticed. These three sensorial values manipulated in order to find the stress levels.

**Simulation results**

Considering the skin resistance as variable resistance ranging from several kilo-ohms which will appropriately drops some voltage across them. The Pspice software is used to simulate the skin resistance detector circuit and simulated output is obtained.
Figure 4. Simulation output 1 with skin resistance 10 kilo-ohm

Figure 5. Simulation output 2 with skin resistance 1 kilo-ohm
Practical Results

The skin resistance detector circuit simulated above is experimented with some practical values and the resistance related to the skin resistance is demonstrated. The voltage across the resistor is taken into account for the final result. The skin resistance is also directly included for the experimentation.

Figure 6. Skin resistance detector circuit consisting of resistor 560 ohms
Formulas and interpretations

In a voltage divider circuit,

\[ V_1 = \frac{R_1}{R_1+R_2} V_s \]
\[ V_2 = \frac{R_2}{R_1+R_2} V_s \]
\[ I = \frac{V}{R_1+R_2} \]

In a non-inverting amplifier configuration,

\[ V_{out} = \left(1 + \frac{R_f}{R_{in}}\right) V_s \]

In a non-inverting differential amplifier configuration,

\[ V_{out} = \left(1 + \frac{R_f}{R_{in}}\right)(V_a - V_b) \]

According to the output obtained from the sensors and the program coded in the microprocessor, the data and the predicted output will be stored in the cloud data and it will be retrieved whenever necessary and after the prescribed time. The retrieved data will be sent as a message through e-mail which will be a report to the user. The SMTP Protocol is used to send the data from the cloud to the e-mail logged in device.

Conclusion

Stress management will surely be a mandatory accomplishment for the upcoming century. Stress can be noticed, analysed and rectified if the people concentrates on it. The system proposed will make a critic note on the daily experience for the better understanding of ourselves. The caretakers of Autistic children...
will also be grateful regarding this type system which handhold them to determine stress. Life of each people will be peaceful regarding a step towards the stress management.

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