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Health Monitoring and Stress Detection System

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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 detecting stress by camera of laptop. 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.

Keywords: Arduino, python, ECG, HR sensor, webcam, face detection algorithms.

1. Introduction

Mental Stress, as a psychological phenomenon or emotional pressure, has a lot to deal with neurological and physiological aspects of the human body. There are experiments to determine stress using heart rate sensors (or) using physiological signals based on soft computing techniques (or) implementing wearable sensors around the body. The set of couple of sensors like heart rate sensor and ECG sensors are used to average the simultaneous data of person in different conditions. In this project we are adding one more feature of facial expression detection by web camera connected to laptop and customized python code with computing methods is running in laptop to process images from webcam. Python code is capable of taking smart decision to send command to arduino connected on serial line to laptop. Arduino itself is having loaded with an application program to read signal from sensors. Code is organized to take final call for stress state situation of person under state. Or based on majority of signal required to take decision for person's stress in Binary way either 1 or 0. The result is displayed on LCD display to see the result.

2. SURVEY OF EXISTING SYSTEM

2.1 Stress Detection in Working People [1]

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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]

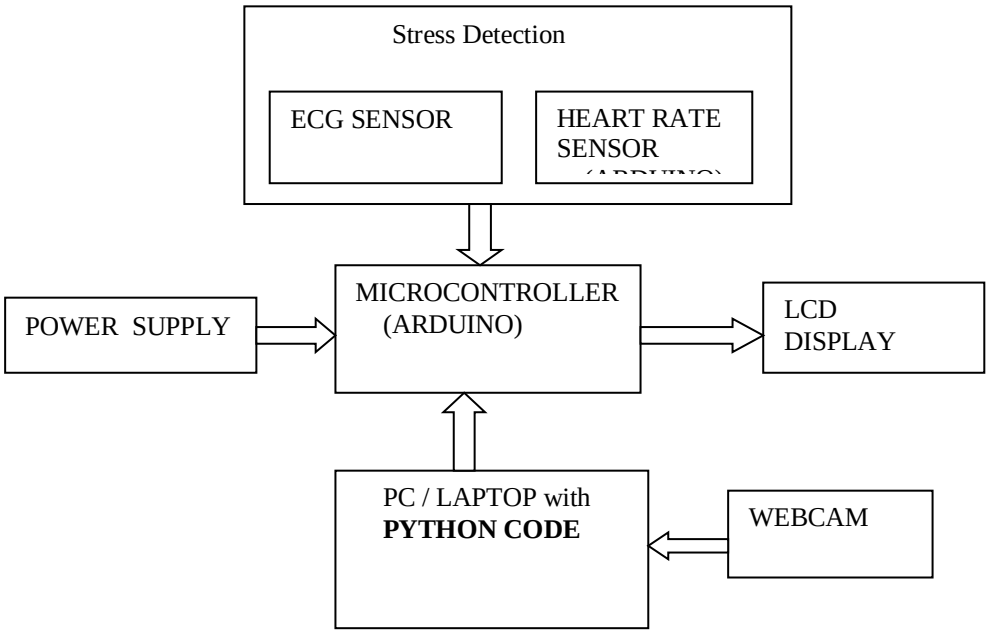
From this research paper it is learnt that even a simple low cost heart rate monitor device or ECG sensor can detect features that change significantly under the influence of mental stress. Using these results we created a simple stress detection algorithm for further testing and refinement in real-life 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 basic camera mounted built in laptop can be used to human mood state by simply capturing images at fix set time in code written in python code. Python is open source development programming language. Python has many free library to write applications using algorithmic functions to process data for machine learning and artificial intelligence technologies. Data analysis, processing, making prediction and forecasting results is achieved through this approach.

3. IMPLEMENTATION PLAN

3.1 Block diagram



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3.2 Hardware details

ECG and Heart rate sensor

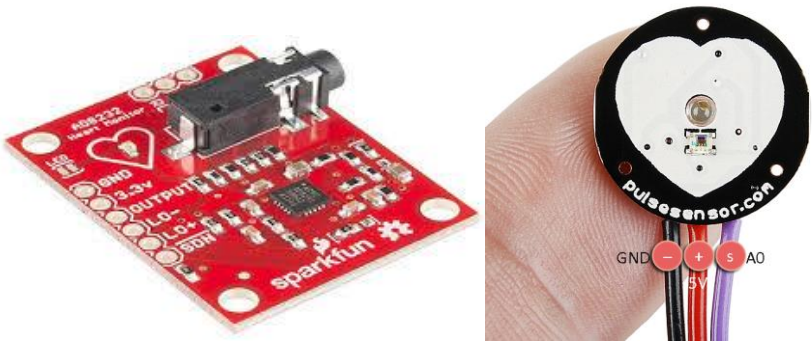

Fig 1. ECG and HR sensor

In this project, we have designed a System using Arduino and Heartbeat Sensor, ECG sensor.

Single Lead Heart Rate Monitor is a cost-effective board used to measure the electrical activity of the heart. This electrical activity can be charted as an ECG or Electrocardiogram and output as an analog reading. ECGs can be extremely noisy, the AD8232 Single Lead Heart Rate Monitor acts as an op amp to help obtain a clear signal from the PR and QT Intervals easily.

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.

The AD8232 is an integrated signal conditioning block for ECG and other bio potential measurement applications. It is designed to extract, amplify, and filter small bio potential signals in the presence of noisy conditions, such as those created by motion or remote electrode placement.

Heartbeat Sensor is an electronic device that is used to measure the heart rate i.e. speed of the heartbeat. Monitoring body temperature, heart rate and blood pressure are the basic things that we do in order to keep us healthy. In order to measure the body temperature, we use thermometers and a sphygmomanometer to monitor the Arterial Pressure or Blood Pressure. Heart Rate can be monitored in two ways: one way is to manually check the pulse either at wrists or neck and the other way is to use a Heartbeat Sensor.

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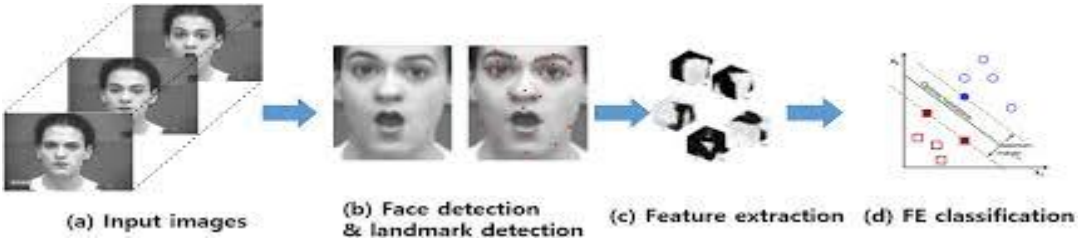
Webcam based image detection using Python



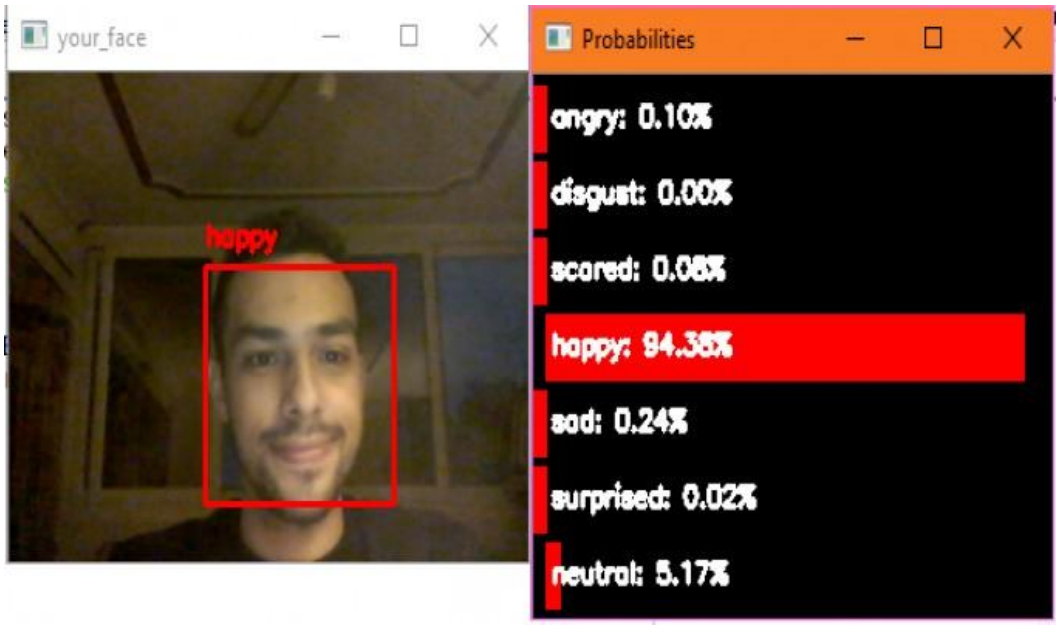


Fig. 2 Face images processing by Algorithms with Python Language and tools

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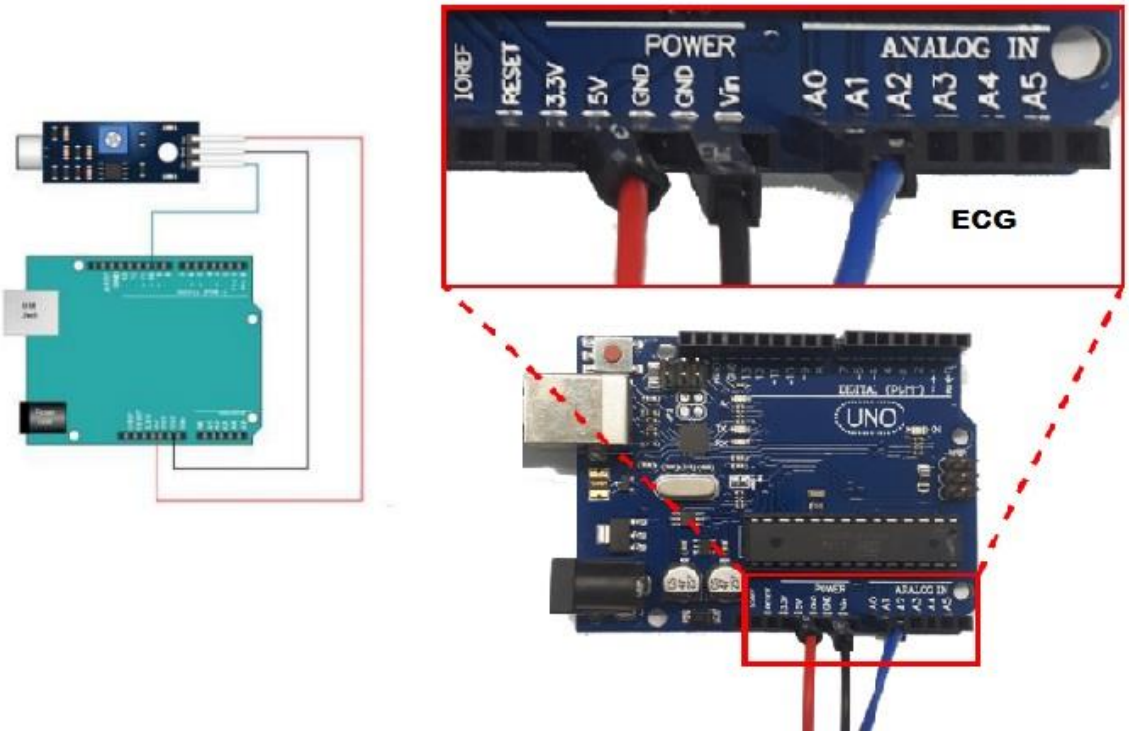

Fig 3 Arduino with sensors

4. RESULTS

Results are collected from both the platforms. One at Laptop end where python is reading images from inbuilt webcam. A suitable algorithms processing images captured are compared and results for emotion is generated for mood detection. On hardware side two sets of sensors are used to physically read data from human body and process in Arduino hardware to identify variation in ECG as well as Heart rate signals to detect an abnormal state of human mental situation. To depict outcomes we can see in fig 4,5,6.

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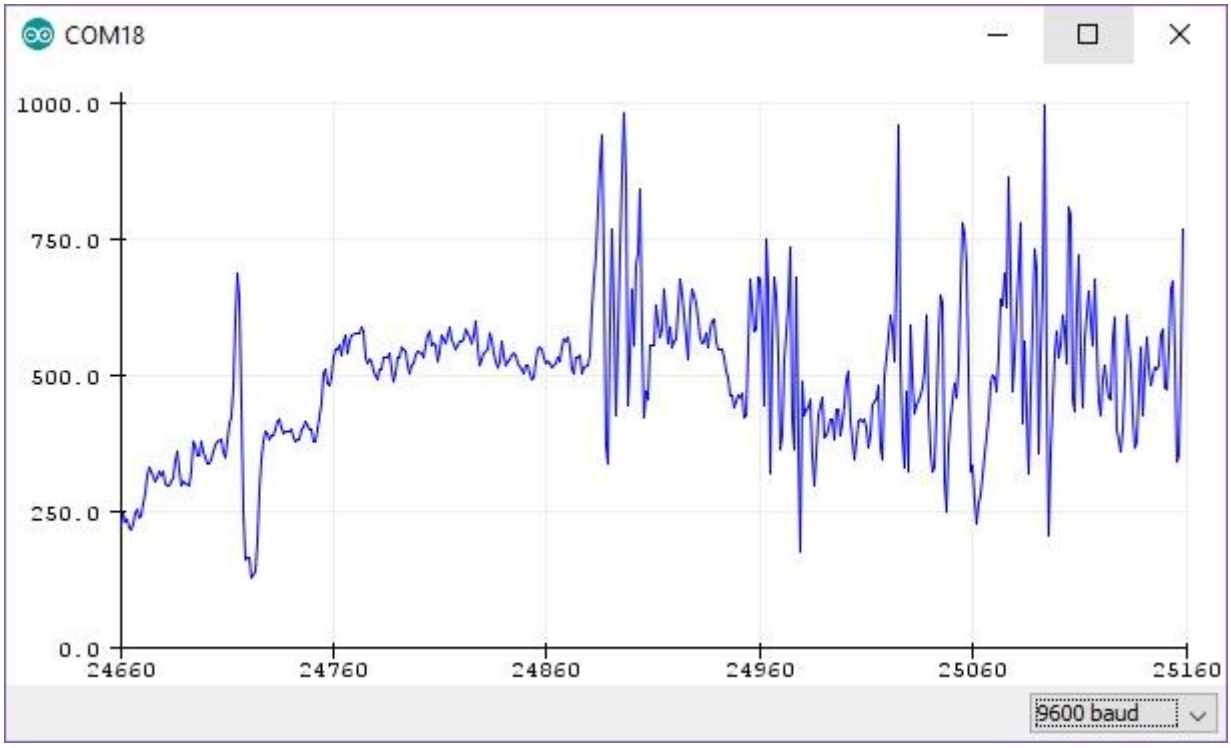

Fig 4. AD8232 hear rate monitor signals

Heart_Rate_Display_Arduino | Arduino 1.6.9

File Edit Sketch Tools Help

Heart_Rate_Display_Arduino

```
void setup()
{

  Serial.begin(9600); // initialize the serial communication:
  pinMode(10, INPUT); // Setup for leads off detection LO +
  pinMode(11, INPUT); // Setup for leads off detection LO -

}
void loop()
{
  if((digitalRead(10) == 1)||(digitalRead(11) == 1)){
    Serial.println('!');
  }
  else
  {

      Serial.println(analogRead(A0)); // send the value of analog input 0:
  }

  delay(10);//Wait for keep serial data from saturating
}
```

Done compiling.

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Fig. 5 Arduino IDE: Application code development

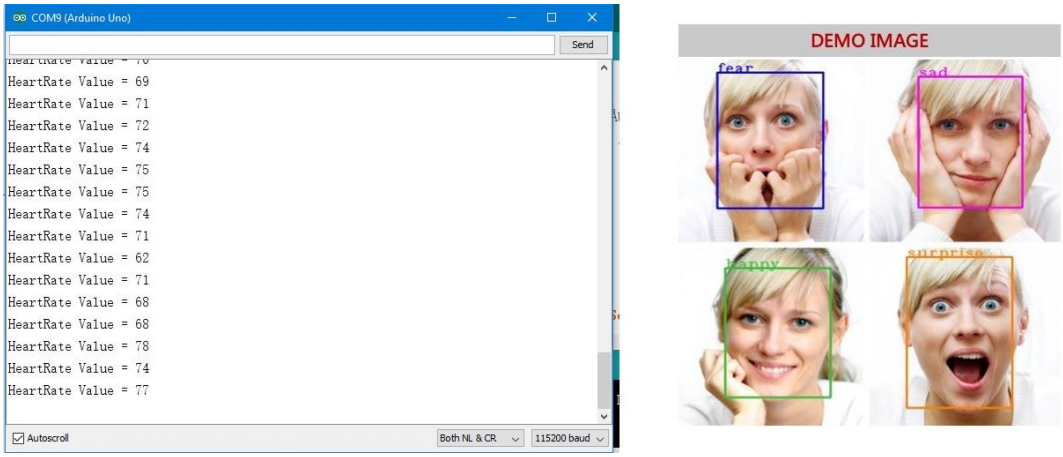

Fig 6. Serial monitor view and Python image detection

5. CONCLUSION

As of now, even with our technological advancements, there is no low-cost reliable solution available for detecting stress. Although there are many mobile applications available regarding e-Health, there is no application to measure stress accurately. Our work uses previously identified stress markers to determine the stress level with low-cost hardware and comparatively higher accuracy. Since this approach involves ECG, we analyze the exact condition of the user with the help of their heart signals.

As well as webcam images are processed using python to send additional support to take health situation information. This is the reason behind improved accuracy and, in the near future, there will be unobtrusive solutions to detect stress levels with less hardware. We have reduced the hardware modules required by coding effective programs to analyze the stress level and by hitting a tradeoff with higher accuracy at the expense of sophisticated devices.

REFERENCES

[1] O. Kofman, N. Meiran, E. Greenberg, M. Balas, and H. Cohen, "Enhanced performance on executive functions associated with examination stress: Evidence from task-switching and Stroop paradigms," Cognition & Emotion, vol. 20, pp. 577-595, 2006.

[2] P. Melillo, M. Bracale, and L. Pecchia, "Nonlinear Heart Rate Variability features for real-life stress detection. Case study: students under stress due to university examination," BioMedical Engineering OnLine, vol. 10, pp. 1-13, 2011.

[3] T. Chandola, A. Heraclides, and M. Kumari, "Psychophysiological biomarkers of workplace stressors," Neurosci Biobehav Rev, vol. 35, pp. 51-7, Sep 2010.

[4] R. L. Pan and J. K. Li, "A noninvasive parametric evaluation of stress effects on global cardiovascular function," Cardiovasc Eng,
vol. 7, pp. 74-80, Jun 2007.

ISSN : 2454-9924

[5] A. H. Marques, M. N. Silverman, and E. M. Sternberg, "Evaluation of stress systems by applying noninvasive methodologies: measurements of neuroimmune biomarkers in the sweat, heart rate variability and salivary cortisol," Neuroimmunomodulation, vol. 17, pp. 205-8, 2010.

[6] M. Weippert, M. Kumar, S. Kreuzfeld, D. Arndt, A. Rieger, and R. Stoll, "Comparison of threemobile devices for measuring R–R intervals and heart rate variability: Polar S810i, Suunto t6 and an ambulatory ECG system," European journal of applied physiology, vol. 109, no. 4, pp. 779–786, 2010.

[7] R. Gevirtz, P. Lehrer, and M. Schwartz, "Cardiorespiratory biofeedback," Biofeedback: A practitioner'sguide, pp. 196–213, 2016.

[8] R. McCraty and F. Shaffer, "Heart rate variability: new perspectives on physiological mechanisms, assessment of self-regulatory capacity, and health risk," Global advances in health and medicine, vol. 4, no. 1, pp. 46–61, 2015.