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The Analysis of Men's Emotional State Based on Heart Rate

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ABSTRACT: The principle of this paper is to develop an arrangement for emotional states assessment, according to pulsometry of the men. The system design comprises the hardware realization of signal detection, pulse wave recording and analysis. The benefits of LabVIEW are well experimental in analysis of the special types of signal, such as pulse and in terms of synchronous recording. The system of virtual instrument creation for recording the pulse wave signal is done using a NI DAQ USB-6008. The design of the block diagrams and the peculiarities of the particular libraries and functions usage are specified.

KEYWORDS: LabVIEW, pulse signal, Heart Rate Variability, DAQ.

I. INTRODUCTION

In present decades, many researchers in the field of normal physiology, safety in transport facilities have been solving a numeral of scientific issues on assessing human emotional responses to a variety of environmental exposures and society. These contain issues related to psycho-emotional state of human, stress management, evaluation of emotional perception of different kinds of information, the study of psycho-physiological mechanisms important to the formation of human emotional behavior and many other issues. The entire scientific discipline, related to the study of emotional perception of the test person at showing to him of different types of stimulus such as visual, audible, tactile, mixed.

The aim of current work is to improve an automated system that implements synchronous recording of human physiological parameters, and successive assessment of emotional perception of the data delivered to test person. This system must record the physiological parameters of the test person during the learning, such as heart rate. In such kind of studies, there is a change of emotional states of the test person. Its unique features are short duration and high intensity, coupled with intense demonstration in performance and work of internal organs. [11] It is important that affects have a strong authority on physiological parameters, in particular on the heart rate. [5] The development of the system includes pulse signal analysis, which fundamentally differs in the ways of recording and processing that requires the relevant software.

The current study concentrates the whole work due to the use of a single program development environment within small group of experts, permitted to create an application for recording and analyzing the required data.

II. RELATED WORK

The following is a brief description of the papers that were studied to understand about emotional states based on heart rate using LabVIEW.

A) An Emotional Analyzed Method Based On Heart Rate Variability.

Chendiwang, Fengwang said that, an emotion recognition technology is used which can potentially aid in assessing and quantifying stress, anger and other emotions harmful to health. They can take reactions to negative emotions and improve the coordination of automatic nervous system to live in a better physiological mental and working status. A large community researcher has been focusing on emotion recognition using different physiological signal.

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Subsequently the acquirement of ECG is much easier than further physiological signals such as EEG, making users feel fewer uncomfortable. It may be conductive to the daily monitoring. Usually it can be developed fast denoising method built on wavelet transform threshold denoising was proposed to development the noisy ECG signal, and then we recognize automatic extraction of HRV sequences. In data processing they propose an improved ECG denoising method based on wavelet transform to extract the RR interval and obtain HRV. The experimental and analytical results indicate that there are significant different emotional changes in HRV including time, frequency, and nonlinear domain. The disadvantages are the wavelet transform decompose only the low pass components of the signals. It can be used only for EEG denoising.

B) Galvanic Skin Responses: A Physiological Sensor System For Affective Computing

P.A.Vijaya and G. Shivakumar said that, a subject whose GSR (Galvanic Skin Response) is to be measured has been played a movie clipping and recorded audio signals or images. People from altered age groups and social background, both male and female have been carefully considered. Due to the variation in emotion, GSR differs. This difference in GSR is recorded for a secure time interval. The GSR is one of several Electro Dermal Responses (EDR). EDRs are modifications in the electrical properties of a person's skin caused by a communication between environmental events and the individual's psychological state. Data acquisition and analysis is carried out by consuming LabVIEW. The new approach introduced in this paper provides a means for structuring, representing and processing emotions within a system without compromising the indefinite nature of emotion. The disadvantage of this paper is hard to stimulate and recognize disgust and use of more than one physiological parameter increases the robustness and reliability of the system.

C) A Real Time Set Up For Retrival Of Emotional States From Human Neural Responses

RashimaMaharajan, DipaliDansal, Shweta Singh said that, an automated workflow established protocol to design an EEG based real time brain computer interface system for exploration and organization of human emotions stimulated by external audio/visual stimulus has been proposed. The automated analysis of physiological signals like EEG has become more extensive throughout the last three decades for the development of BCI to include areas like stress, lie detection and emotion measurement. The robust technique to detect and classify human emotions automatically by merely analyzing the brain activity of subject using MATLAB based algorithms without compromising with the accuracy while decreasing complexity and responses time of system. This shall be followed by the improvement of MATLAB based self-defined algorithm to capture and distinguish temporal and spectral differences in EEG under emotional stimulations. Real time implementation of BCIs for acquiring and analyzing EEG signals to discriminate human emotions with reduced difficulty and response time of the system. Disadvange of this paper is, it can be slowing process and expensive.

III. OVERVIEW OF LABVIEW

For several years, National Instruments (NI) LabVIEW software has been known as a simple to use development tool for constructing data acquisition and instrument control systems rapidly. The NI LabVIEW graphical programming language, by means of its integrated graphical user interface, is especially suited for rapidly prototyping systems. On the other hand, the simplicity and speed of raising a system with LabVIEW has unseen the fact in some ways. LabVIEW is suitable for handling large and complex applications. For this purpose it is called as a complete programming language.

LabVIEW is an extremely productive development for building custom applications that interact with signals or real word data in fields such as science and engineering. LabVIEW contains various components and it is a software development environment, several of which are essential for any type of test, control application or measurement. LabVIEW is unique because it makes this wide variety of tools offered in a single situation, ensuring that compatibility is as simple as drawing wires between functions.

IV. SYSTEM DESIGN

To implement the target goal, the Laboratory Virtual Instrumentation Engineering Workbench (LabVIEW) was chosen. It is a graphical environment of software development. A program written in a LabVIEW environment is called and denotes the virtual instruments and consists of two parts,

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- Block diagram, relating the logic of virtual instrument operation.
- Front panel, relating the external interface of virtual instrument.

The following is the software and hardware configuration required for this paper.

A) SOFTWARE REQUIRMENTS

- OS : Windows, OS X, Linux.
- Simulator : LabVIEW version 12

B) HARDWARE REQUIREMENTS

- USB 6008 DAQ
- Pulse wave sensor
- Personal computer
- USB

The main aim of software requirements specification is to entirely specify the technical requirements for the software product in a concise and unambiguous manner.
The purpose of DAQ is to measure an electrical or physical phenomenon such as current, voltage, sound, temperature, and pressure. The DAQ systems has the following parts involved, these are physical input\output signals, DAQ devices\ hardware, driver software, and application software. The device has the following specification; it connects to the computer via the USB interface and that is a big advantage, no more power supply needed, and compatible with LabVIEW.

Acquisition card national instruments USB-DAQ 6008 allows data acquisition for mobile measurements, practice and lab measurements. Maximum sample speed by each analog input is 48kS\s. Sample speed on analog output is 150S\s and it can't be changed. Analog inputs have 14 bit resolution and analog output have 12 bit resolution. USB interface allows better transferability and easier to connecting with the pc. Maximum voltage that can be connected to analog inputs is from -20v to 20v. Analog output voltage is from 0 to 5v and it cannot be changed.

At digital inputs it can be associated voltage from 0 to 5v and at digital outputs it gives 5v. The card also has a counter that gives voltage from 0 to 5v and maximum frequency of 5MHz.

V. SYSTEM ARCHITECTURE DESIGN

Toconduct such experimentation, the research system was set up, which includes software and hardware and contain components that implements, record of physiological and anthropometric characteristics and joint analysis of the acquired data. The development of the system contains pulse signal analysis, which fundamentally differs in the way of recording and processing that required the applicable specified software. Architecture of the proposed system is shown in fig 1.

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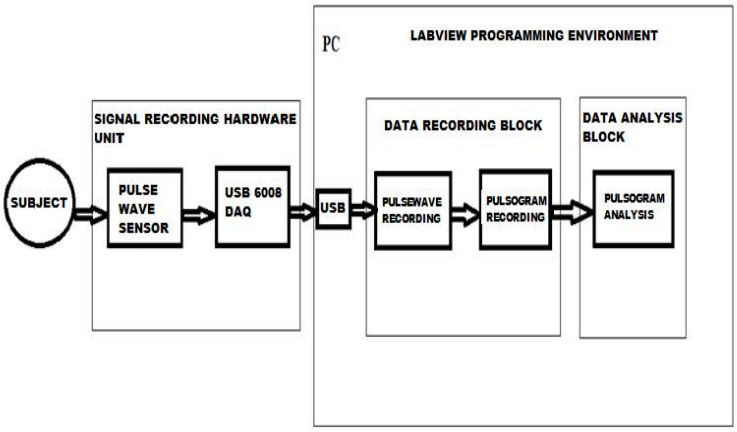

Fig 1. System Architecture Design

From fig 1, further the test person the system includes three major parts:

1. The hardware block of signal recording
2. Data record block
3. Data analysis block

Signal recording hardware contains devices to take off all the necessary human physiological parameters. Data record block is implemented on the beginning of software improvement by collecting and saving in memory of pc information, recorded from the test person. The data analysis block is processing data and graphical representation of the information, formerly recorded in data record block.

VI. PULSE WAVE RECORDING

To verify the pulse values and their accumulation in pulsogram, the pulse wave record of test person is necessary. For this reason, besides the development of hardware, it is required to generate the program code in LabVIEW, implementing the record and mapping of the pulse signal in the front panel. With the help of DAQmx library of LabVIEW environment, data record in LabVIEW from NIDAQ 6008 device, which was attached to the pulse wave sensor, has been implemented.

DAQ hardware acts as the interface among the computer and the outside world. NI USB 6008 is well suited for education purpose because it is a small size and easy USB connection. The card also has a green control LED that switches on when the card is associated to a pc via USB. If LED is not switched on card is not connected properly. If it flashes that means that the card is in function. At the beginning of using the card it is required to install a driver that is obtained on a compact disk with the card. Program measurement & automation explorer needs to be installed. Measurement & automation explore is used to assessment the card reset it and adjust is characteristics.Block diagram of pulse signal initialization and record is shown in fig 2.

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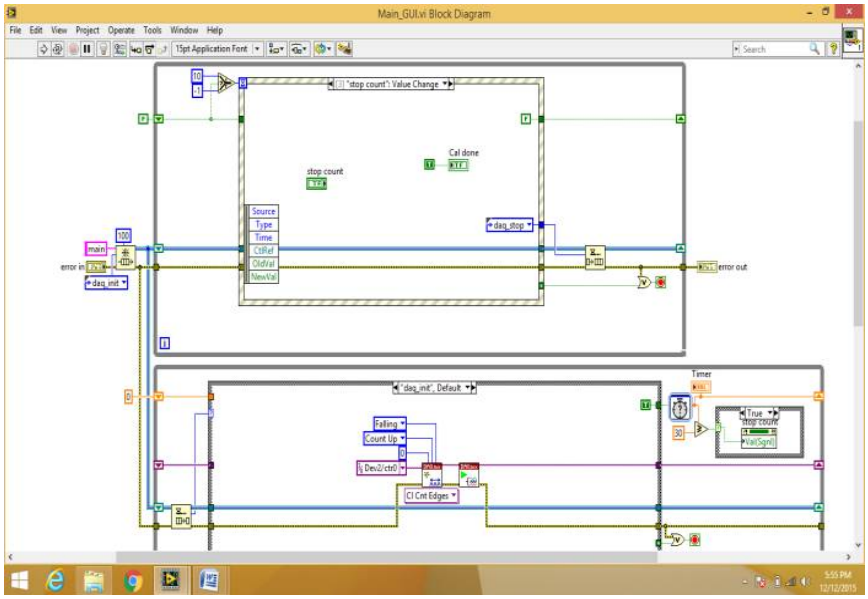

Fig 2. Design of Pulse Wave Record in LabVIEW

From fig 2, DAQmx Create Virtual Channel.vi function, considered to generate a recording channel from data acquisition block, allowed specifying the boundary values of signal amplitude, to select the record channel number and type of recorded signal, such as current, voltage, temperature, etc. To turn on the signal record assembly at virtual instrument start up, DAQmx Start Task.vi function was implemented. By using the DAQmx Timing.vi function, the sampling frequency of the pulse signal wave of 60 Hz was set up.

Stop button of the major cycle turns off the session, due to this DAQmx read.vi function that could read the specified number of samples per cycle and was placed inside the main cycle and the above started functions were located outside the cycle. The DAQmx clear task.vi function, performing the end of the recording process was set outside the cycle. The output of pulse wave signal display on front panel as shown in fig 3.

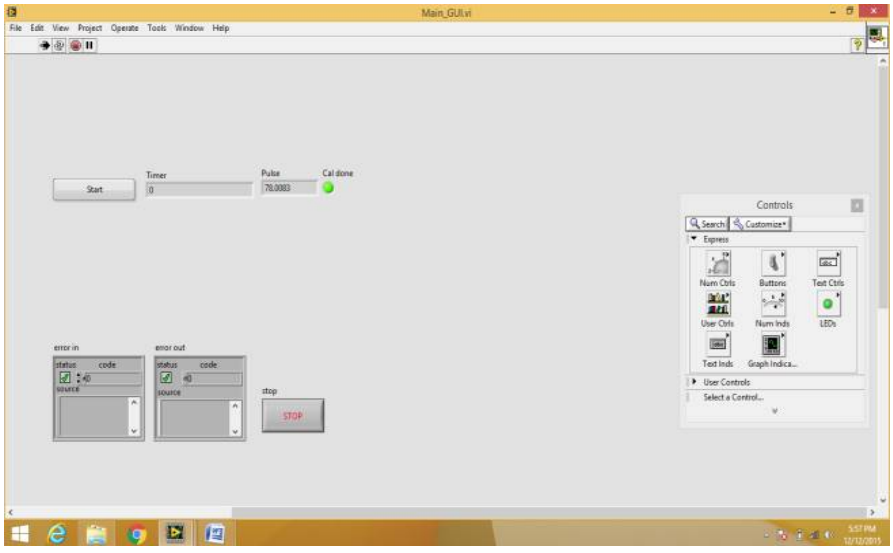

Fig 3. Pulse Signal Record Output

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From fig 3, by using, the assignment of signal record from the data acquisition devices in LabVIEW environment can be solved. It is a graphical boundary of measurement tasks and channels adjustment. The capability of quick signal record channel adjustment and showing the target result is the advantages of its usage.

The advantage of LabVIEW are in the analysis of the special types of signal such as pulse signal and in terms of the synchronous recording, reduced updating errors and increased consistency, grater data integrity and independence from application program, reduced data redundancy, improved data security, reduced data entry, storage and retrieval cost.

VII. CONCLUSIONAND FUTURE WORK

The conclusion of the planned work is the automated system improvement for the assessment of men's emotional states on the basis of pulse assessing and analyzed the characteristics of the recorded signals. In future work there is a possibility of facial expression by using video with sound. The most significant in settling the task is to get the characteristic features in facial video, which specifies the change in emotional reactions to the stimulus and their time correlation with visual scenes of the provided material is determined.

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