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A Review on Real Time Heart Rate Monitoring System using MATLAB

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Abstract -Our main objective is to implement a monitoring system which monitors the heart pulse of a patient. This work presents a novel easy-to-use system intended for the fast and non invasive monitoring of the Lead I electrocardiogram (ECG) signal by using a wireless steering wheel. The steering wheel used here is a prototype model. A novel heart rate detection algorithm based on the continuous wavelet transform has been implemented, which is specially designed to be robust against the most common sources of noise and interference present when acquiring the ECG in the hands. Skin Electrodes were used to record the nerve voltages for monitoring the heart pulse. The voltages recorded will be sent to an instrumentation amplifier which amplifies the signal, and then to a filter which filters the noise. Thus, analog signal is given to Analog-to-Digital Convertor (ADC) of Arduino. There, analog voltages are been converted to digital and that digital values will be stored in the EEPROM of Arduino. The values stored in EEPROM will be sent to PC via XBEE (IEEE 802.15.4) wirelessly and a serial port will be opened in the MATLAB by using a serial object. GUI is programmed to make the user interface interactive and simple. Using the real time plot, I've plotted the values received by XBEE module and making a running waveform which displays when the MATLAB sent a query to Arduino.

Keywords: MATLAB, Hear rate, Monitoring, Real time

Literature Survey:

M. K. Islam et al. (2012) proposed the study and analysis of ECG signal processing by means of MATLAB tool effectively. Study of ECG signal includes generation & simulation of ECG signal, acquisition of real time ECG data, ECG signal filtering & processing, feature extraction, comparison between different ECG signal analysis algorithms & techniques (i.e. Wavlet transform or so), detection of any abnormalities in ECG, calculating beat rate and so on using the most familiar and multipurpose MATLAB software along with LABVIEW. The proper utilization of MATLAB functions (both built-in and user defined), toolbox and Simulink can lead us to work with ECG signals for processing and analysis both in real time and by simulation with great accuracy and convenience.

J.S.Prasath (2013) proposed This paper describes the development of wireless monitoring of a heart rate based on a microcontroller. We can record the ECG signals and Heart beats of all patients in a single computer. These biomedical signals are acquired and then processed with a microcontroller. After processing, all data are sent to a communication interface that can send this information to a personal computer. For the patient suffering from the cardiac disease it is very necessary to perform accurate and quick diagnosis. For this purpose a continuous monitoring of the ECG signal, patient's current heart rate and BP are essential. We can monitor the patient's ECG signal by using Bluetooth transmission and reception in the central place in any hospital. The MATLAB software is used to simulate the ECG waveform.

Larissa Carvalho et al. (2014) proposed a non invasive heart rate monitoring system, to monitor subjects of different age groups using Digital Image Processing. Using this method, it is possible to visualize the flow of blood as it fills the face. From this result, it is possible to extract the subject‟s heart rate. The main field of research is Image processing and computer Vision. Variations in videos that are difficult or impossible to see with the naked eye are revealed by taking a standard video of the subject as input, performing face tracking and applying pyramid decomposition, followed by filtering of the frames. The resulting signal is then amplified to reveal hidden information. We are thus able to visualize the flow of blood as it fills the face. This method is based on the Eulerian Video magnification algorithm presented at SIGGRAPH 2012.

JULIO CESAR BALLESTEROS BORRERO et al. (2016) describes PPG signals measured from the wrist are often subjected to distortion and noise. Signal processing techniques that tackle these issues were investigated and implemented. The algorithm of choice was JOSS. JOSS consists of sparse signal reconstruction, spectral subtraction and spectral peak tracking. The combination of these techniques is what results in a robust heart rate tracking algorithm.

Animprovement, interms of computing power, was madeby analysing general properties of PPG signals. The outcome is anewframe work named SMART, which combinestheHR tracking power of a robust HR monitoring system, like JOSS, with the speed of faster HR monitoring methods. The

overall result is a fast algorithm that computes the heartrate with an average absoluteerrorof1.42. Thisresult shows that PPGb as edheartrate monitoring on wearable devices has great potential for fitness and medical purposes.

AlampreetChahal et al. (2017)presents a relation between heart rate and vowel speech signal. The proposed method is based on modeling the relationship between speech production of vowel speech signals and heart activities of human. The Adaptive filter is used to manipulate signals to reject unwanted characteristics for accurately monitoring the heart rate. Simulation results show that the proposed method provides more accuracy as compared with existing methods. There is linear relationship between results obtained from proposed method and clinical method.

AlladaTirupathiRao et al. (2017) objective is to implement a monitoring system which monitors the heart pulse of a patient. This work presents a novel easy-to-use system intended for the fast and non invasive monitoring of the Lead I electrocardiogram (ECG) signal by using a wireless steering wheel. The steering wheel used here is a prototype model. A novel heart rate detection algorithm based on the continuous wavelet transform has been implemented, which is specially designed to be robust against the most common sources of noise and interference present when acquiring the ECG in the hands. Skin Electrodes were used to record the nerve voltages for monitoring the heart pulse. The voltages recorded will be sent to an instrumentation amplifier which amplifies the signal, and then to a filter which filters the noise. Thus, analog signal is given to Analog-to-Digital Convertor (ADC) of Arduino. There, analog voltages are been converted to digital and that digital values will be stored in the EEPROM of Arduino. The values stored in EEPROM will be sent to PC via XBEE (IEEE 802.15.4) wirelessly and a serial port will be opened in the MATLAB by using a serial object. GUI is programmed to make the user interface interactive and simple. Using the real time plot, I've plotted the values received by XBEE module and making a running waveform which displays when the MATLAB sent a query to Arduino.

Gaurav Kumar et al. (2017) describes physicians' understanding of biosignals as measured with medical instruments becomes the foundation of their decisions and diagnoses of patients, as they rely strongly on what the instruments show. Thus, it is critical and very important to ensure that the instruments' recordings exactly reflect what is happening in the patient's body so that the acquired signal is the real one or atleast as close to the real in body signal as possible. The following paper deals with the analysis of PPG (Photo plethysmography) signal to measure heart rate and analysis of resistance change in thermistor for temperature measurement by the means of MATLAB tool effectively. Study of PPG signal include generation of PPG signal, amplification of PPG signal and PPG signal filtering and study of resistance change in thermistor include linearization of the acquired data, measuring the resistance change and interpreting the data. This project is been inspired by the need to find an efficient method for heart rate and temperature analysis which is simple and has good accuracy and less computation time.

H. Rahman et al. (2017) describes heart Rate (HR) is one of the most important Physiological parameter and a vital indicator of people's physiological state and is therefore important to monitor. Monitoring of HR often involves high costs and complex application of sensors and sensor systems. Research progressing during last decade focuses more on noncontact based systems which are simple, low-cost and comfortable to use. Still most of the noncontact based systems are fit for lab environments in offline situation but needs to progress considerably before they can be applied in real time applications. This paper presents a real time HR monitoring method using a webcam of a laptop computer. The heart rate is obtained through facial skin color variation caused by blood circulation. Three different signal processing methods such as Fast Fourier Transform (FFT), Independent Component Analysis (ICA) and Principal Component Analysis (PCA) have been applied on the color channels in video recordings and the blood volume pulse (BVP) is extracted from the facial regions. HR is subsequently quantified and compared to corresponding reference measurements. The obtained results show that there is a high degrees of agreement between the proposed experiments and reference measurements. This technology has significant potential for advancing personal health care and telemedicine. Further improvements of the proposed algorithm considering environmental illumination and movement can be very useful in many real time applications such as driver monitoring.

N.V. Hoan et al. (2017)describes with the development of smartphone technologies enable photoplethysmogram (PPG) acquisition by camera and heart rate (HR) measurement. This papers presents improved algorithm to extract HR from PPG signal recorded by smartphone camera and to develop real-time PPG signal processing Android application. 400 video samples recorded by Samsung smartphone camera are imported as input data for further processing and evaluating algorithm on MATLAB. An optimized algorithm is developed and tested on Android platform with different kind of Samsung smartphones. To assess algorithm's performance, medical device Beurer BC08 is used as reference. According to

related works, accuracy parameters includes 90% number of samples that has relative errors less than 5%, Person correlation (r) more than 0.9, and standard estimated error (SEE) less than 5 beats-per-minutes (bpm).

KainatZeba et al. (2018) proposed Technological innovations in the field of disease prevention and maintenance of patient health have enabled the evolution of fields such as monitoring systems. This concept deals with the detection of heart attack and heart rate monitoring. It is an android application which continuously monitors the patient's heart beat rate and sends appropriate notifications to the registered users. This will help doctors to monitor the health of remotely located patients, thus enabling a smart health care system. This project can help save the lives of patients in nick time.

Conclusion: Biomedical engineering (BME) combines the design and problem-solving skill of engineering with medical and biological sciences to improve patient's health care and the quality of life of individuals. Cardiovascular disease is one of the major causes of untimely deaths in the world, heart beat readings are by far the only viable diagnostic tool that could promote early detection of cardiac events. By using this we can measure one's heart rate through fingertip. This paper focuses on the heart rate monitoring and alert which is able to monitor the heart beat rate of the patient. The hardware setup enables us to determine the heart beat rate per minute and then send notification to the mobile phone. It is portable and cost effective. It is a very efficient system and very easy to handle and thus, provides great flexibility and serves as a great improvement over other conventional monitoring and alert systems.

References:

1. Alampreet Chahal1, Silki Baghla2, Gautam Kaushal3, Dr.Rajbir Kaur4, "A SIMPLE APPROACH FOR HEART RATE MONITORING USING ADAPTIVE FILTERS", International Journal of Advance Engineering and Research Development Volume 4, Issue 6, June -2017.
2. 1Allada TirupathiRao, 2M.Gopi, 3M.V.S.S.Prasad, "Real Time ECG Signal Transmission for Remote Monitoring", Real Time ECG Signal Transmission for Remote Monitoring, ISSN: 2321-9939.
3. Gaurav Kumar, Km. ShilpaMaurya, GargiGoyal, "Design and Development of Heart Rate and Temperature Measuring Device Using MATLAB", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 6, Issue 5, May 2017.
4. H. Rahman, M.U. Ahmed, S. Begum, P. Funk, "Real Time Heart Rate Monitoring From Facial RGB Color Video Using Webcam", The 29th Annual Workshop of the Swedish Artificial Intelligence Society (SAIS). 2–3 June 2016, Malm Sweden.
5. J.S.Prasath, "Wireless monitoring of Heart Rate using Microcontroller", International Journal of Advanced Research in Computer Science and Electronics Engineering (IJARCSEE) Volume 2, Issue 2, February 2013.
6. Kainat Zeba1, Lakshmi S Patil1, Sanjana R Gowda1, Varsha R1, Mrs.Shobha Chandra K2, "Real Time Heart Attack and Heart Rate Monitoring Android Application", International Journal of Computer Science and Mobile Computing, Vol.7 Issue.4, April-2018.
7. Larissa Carvalho1, Mr. H.G.Virani2, Mr.Shajahan Kutty3, "Analysis of Heart Rate Monitoring Using a Webcam", International Journal of Advanced Research in Computer and Communication Engineering Vol. 3, Issue 5, May 2014.
8. M. K. Islam, A. N. M. M. Haque, G. Tangim, T. Ahammad, and M. R. H. Khondokar, "Study and Analysis of ECG Signal Using MATLAB & LABVIEW as Effective Tools",International Journal of Computer and Electrical Engineering, Vol. 4, No. 3, June 2012.
9. N.V. Hoan†, Jin-Hyeok Park†, Suk-Hwan Lee††, Ki-Ryong Kwon†††, "Real-time Heart Rate Measurement based on Photoplethysmography using Android Smartphone Camera", Journal of Korea Multimedia Society Vol. 20, No. 2, February 2017(pp. 234-243).
10. JULIO CESAR BALLESTEROS BORRERO, TIAMUR ALI KHAN, "HeartratemonitoringusingPPGsignals", Delft, June 15, 2016.