Contactless Heart Rate Analyzer

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Abstract — **An irregular heart rate reflects the high risk of cardiovascular diseases, hence it's a major indicator of cardiac health. The traditional ways rely on physical contact and may bring inconvenience in practice. For example, a patient may feel uncomfortable when he has to wear the adhesive equipment for a long time, especially elderly people or new-borns. Also, in the existing systems results are not stored for future reference. The proposed system will be a contactless heart rate estimation technique using webcam. For contactless measurement a photoplethysmography method will be employed. According to the change in blood volume in human face the reflected light intensity changes, from these changes the photoplethysmography (PPG) signal can be acquired which will be used for heart rate estimation. User's face will be detected from the input video. For extracting PPG signals, Region of Interest (ROI) will be selected from the detected face. Further, video magnification will be used to amplify the subtle changes in the intensity of the reflected light from the user's face will be detected. The reflected light intensity variation gives the PPG signal for heart rate estimation. The recorded data will be then classified as normal or abnormal. From the classified data, if the results are continuously abnormal then the user will get an alert. The proposed system is a real time application which would work without the use of additional hardware units for non-invasive heart rate measurement and storage of results in easily interpretable classified format for future references & generating alert in real time.**

Keywords —Heart rate, contactless, webcam, photoplethysmography (PPG), Region of Interest (ROI), alert

I. Introduction

Heart rate refers to the number of heartbeats per minute, which is one of the important indicators of heart health. Measuring the heart rate is an easy way to gauge our health. Each person's heart rate determines their fitness level. Normal heart rate may vary from person to person and a usually high or low resting heart rate can be a sign of trouble. Traditionally, the heart rate can be measured by using a stethoscope or [illegible]am, or even by feeling the pulse. In addition, a growing number of wearable devices are invented to detect human heart rate. However, these methods rely on physical contact, which makes the measurement inconvenient for some patients. At present, the current standard techniques for heart rate measurement like electrocardiograms (ECG) are uncomfortable and hinder the patient. Other, more comfortable techniques like pulse oximetry or sphygmology have their very own penalties in addition to a lower accuracy compared to the standard. An example for the disadvantage when using the pulse oximetry is the measuring error or complete malfunction when the patient has cold hands or a circulatory disorder.

According to the studies conducted on the disease burden trend it is found that about 62.5 million people lost prematurely due to cardiovascular diseases.7.1% of the total death rate reported in 1990 is due to heart rate and in 2016 the death rate is increased up to 12.2%. In order to reduce the death rate earlier detection of the heart disease is required. Regular monitoring of heart rate is important in such situations. A regular heart rate for an adult is between 60 and 100 beats per minute. Recent studies suggest a heart rate higher than 76 beats per minute there is a higher risk of heart attack.

The proposed system is a contactless system for real time heart rate analysis from user's facial video without the use of additional hardware units. The resulting heart rate of the user would be stored in a classified format as high, low or normal thus maintaining easily accessible records of the user. If the results are continuously abnormal, then the system will trigger an alert.

II. Related Works

Considerable researches have been conducted previously on heart rate measurement. Litchman.A. et al. proposed an ECG system which consists of two main parts. The first part is an analog amplifier with maximum gain of 1800. The analog amplifier is powered by the battery to prevent network interference and consists of three parts - the first amplification stage, the second amplifier stage and the active filter [1]. Only one amplifier could be used, but it would also amplify the undesirable interference that is always present while scanning bio signals. J Kiljander et al. developed a

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