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Pulse Calculator using Webcam

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Abstract - *Heart rate (HR) monitoring in the healthcare aims to equip providers with meaningful data to monitor the health, prognoses symptom and improve the driving safety for the transportation. It is a hot topic for accidents prevention via monitoring the driver's physical condition. However, physiological data collection is a long-term, continuous process that poses various challenges. A camera-based HR detection is as follows. First, facial video is collected over a certain period. Then the facial images are separated into the three RGB channels, and the resulting two-dimensional images are transformed into one-dimensional time-series signals. Each channel signal is normalized, defriended and processed using the independent component analysis (ICA). Afterwards the signals are filtered via band pass filtering and fast Fourier transformation (FFT) to extract the HR. Keyword: - Independent Component Analysis, Heart Rate, Electro cardio graph, Photo plasma graph.*

***Key Words*: Independent Component Analysis, Heart Rate, Electro cardio graph, Photo plasma graph.**

1. INTRODUCTION

Heart rate (HR) monitoring in the healthcare aims to equip providers with meaningful data to monitor the health, prognoses symptom and improve the driving safety for the transportation. It is a hot topic for accidents prevention via monitoring the driver's physical condition. Although some researchers use an electrode integrated into the driving seat to obtain the ECG signal during driving these methods are uncomfortable for the drivers. In some studies, several non-contact techniques have been proposed to estimate HR of drivers. It used the continuous-wave Doppler radar to detect the HR of the driver. It also used a microwave sensor and template matching algorithm to monitor the HR of the driver. It is well known that a webcam can be used for non-contact measurement of HR and respiration rate via image processing.

1.1 Need

The need for our project Pulse Calculator Using Webcam System is as:

- This project aims to create a real time, noncontact heart rate monitoring program that utilizes a simple camera to capture facial information.
- Also, the success of this project would provide users access to accurate heart rate. Save time for the process.

1.2 Goals and Objectives

In order to improve the robustness in real-world applications, two key issues have to be handled in the future: light effects and body movements. For the former issue, color enhancement algorithms such as Retinex may be applicable to decrease the light effects. For the latter issue, more robust object tracking algorithms can be further integrated to collect stable feature values. Besides, the proposed method can detect more than one skin regions from a person. The performance may be further improved by combining the measured heart rates from multiple body parts.

2. Problem Statement

The primary goal of this project is to deliver a functional proof of concept by the end of the second quarter of Major Project. The minimum value criteria include a number of constraints.

- The application can isolate a human face from a video feed.
- The application can extract an estimated heart rate.
- The application can run in real time (heart rate updates occur at the frame rate of the camera).

3. Existing System

This project aims to create a real time, non-contact heart rate monitoring program that utilizes a simple camera to capture facial information. Heart rate is one of the most commonly measured physiological makers, and provides the user with important feedback on their current state of health. In the past, it has been necessary to have direct contact to the skin in order to measure one's heartbeat. With the advent of powerful computer vision processing libraries, such as OpenCV, and advanced signal filtering techniques, it is now possible to extract accurate heart rate measurements through facial recognition and independent component analysis (ICA). The success of this project would provide users access to accurate heart rate.

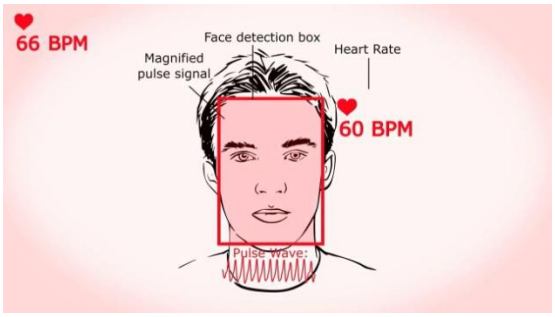


Fig -1: Pulse Calculator Using Webcam

4. Literature Survey

Table -1: Comparison with Pulse Calculator Using Webcam

Comparison with Pulse Calculator Using Webcam			
Year	**Authors**	**Methodology**	**Shortcomings**
2012	KUAL-ZHENG LEE, PANG-CHAN HUNG, AND LUO-WEI TSAI.	A contact-free heart rate measurement method using an ambient light camera is proposed.	It takes more time to determine the pulse rate.
2013	ISAYIYAS NIGATU TIBA AND LI	The method implements the haar cascade classifier algorithm presented in opencv to detect human face.	It determines on graphical interface and also image based
2014	QI ZHANG, GUO-QING XU, MING WANG, YIMIN ZHOU	The RGB colour fluctuation during image processing and blind source separation technology in video tracking are used for information extraction.	It use blind source separation technology in video tracking.
2016	H. RAHMAN, M.U. AHMED, S. BEGUM, P. FUNK.	The heart rate is obtained through facial skin colour variation caused by blood circulation.	Skin colour variation are determine mean hr.
2016	AKIHITO SEKI, CHANGQIN QUAN, ZHIWEI LUO	Hr was measured simultaneously using an electro cardiographs (ECG) device during all sessions of the experiment.	The results are not accurate
2018	QI ZHANG, YIMIN ZHOU (MEMBER IEEE),	Heart rate (HR) detection is proposed via near infrared facial video data	Indoor and outdoor shows different results.
2018	DANILO EMILIO DE ROSSI	These methods are based on subtle colour changes or motions of the face due to cardiovascular activities, which are invisible to human eyes but can be captured by digital cameras	It doesn't have any drawbacks.

5. Proposed System

This project aims to create a real time, noncontact heart rate monitoring program that utilizes a simple camera to capture facial information. Heart rate (HR) monitoring in the healthcare aims to equip providers with meaningful data to monitor the health, prognoses symptom and improve the driving safety for the transportation. It is a hot topic for accidents prevention via monitoring the driver's physical condition.

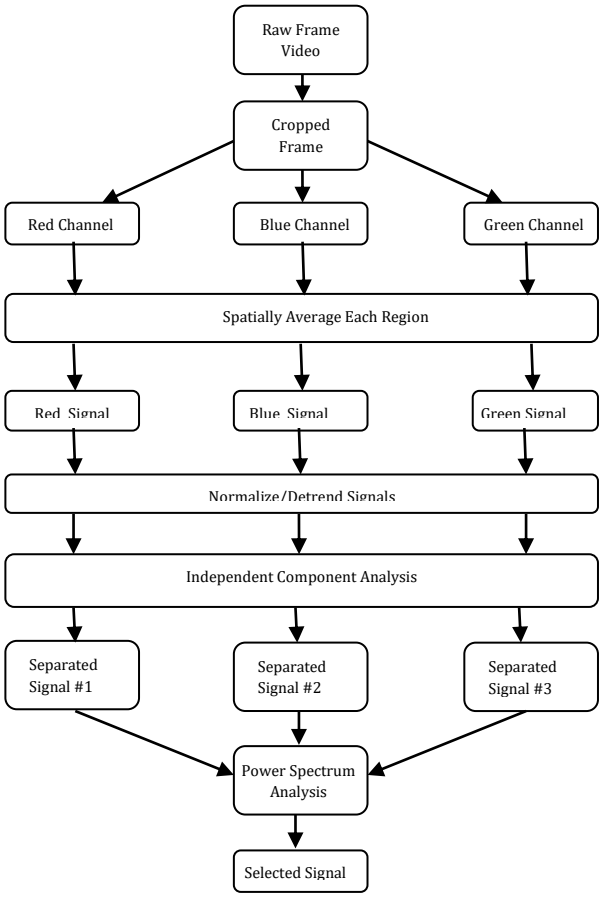


Fig-2: Architecture of Proposed System.

5.1 MATERIALS AND COMPONENT

The experiment was taken place in two phases: firstly, the real time HR extraction was conducted along with stress system as a reference. All the facial image frames were saved for offline testing. Secondly HR was extracted again in offline using the saved film image sequences.

5.1.1 Data Collection

Data acquisition was conducted by 10 participants (all are male) of different ages (25 to 50 years) and skin colors. The experiments were carried out in indoors and with a sufficient amount of ambient sunlight. The participants were informed the aim of the study and they seated at a table in front of a laptop computer at a distance of approximately 0.5 m from the built-in webcam (HP HD webcam). During the experiment, participants were asked to keep still, breathe spontaneously, and face the webcam while their video was recorded for 5 minutes. HR was extracted in real time and saved in an excel file. All facial

image frames (24-bit RGB) during real time HR extraction were recorded sequentially at 30 frames per second (fps) with pixel resolution of 640 × 480 and saved in PNG (Portable Network Graphics) format in the laptop. Simultaneously HR was also recorded using ECG sensors and stress system. After the real time extraction, HR was also extracted again in offline from the saved film image sequences.

5.1.2 Applied Algorithms

Three algorithms such as FFT, ICA and PCA have been applied at the same time but separately to extract HR in real time using only facial video. The average of the R, G and B signals were calculated for FFT method. For the ICA method. The data collection was supposed to perform in sitting position without any movement but in reality, the test persons moved their hands and heads little bit which is the cause of motion artifacts. Therefore, ICA is used which is able to remove motion-artifact by separating the fluctuations caused by small motions or movement. Interestingly, ICA returns the independent components randomly and the component whose power spectrum contained the highest peak is then selected for further analysis. Similarly, the normalized raw traces are also decomposed by PCA to find the principal components. Finally, the Fast Fourier Transform (FFT) is applied on the selected source signal to obtain the power spectrum. The pulse frequency was designated as the frequency that corresponded to the highest power of the spectrum within an operational frequency band.

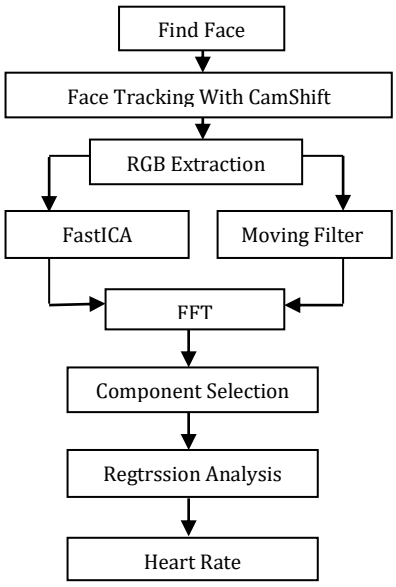


Fig-3: Using CamShift Algorithm

5.1.3 Hardware Interfaces

There are A RBG Camera required to take video of an Object. Object such are human being.

5.1.4 Software Interfaces

Software in Run on Windows and is code in PyCharn IDE it bases on Python programing language the Hardware RGB Camera is connected to device and it takes the video of Object and by analyzing it show the Pulse Rate of an Object.

6. IMPLEMENTATION

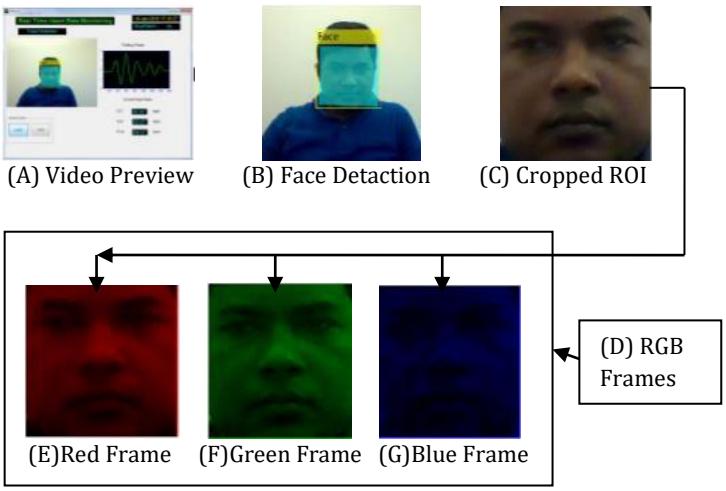
The primary goal of this project is to deliver a functional concept by the end of the second quarter of Senior Project. The minimum value criteria include a number of constraints.

- The application can isolate a human face from a video feed.
- The application can extract an estimated heart rate.
- The application can run in real time (heart rate updates occur at the frame rate of the camera).

At minimum, this project aims to verify the applicability of the ICA algorithm by the end of the first quarter. Beyond that, this project aims to produce some level of functionality by the end of the first quarter. As a stretch goal, OpenCV also has a machine learning component included in the library which can be used to continuously improve the facial recognition algorithm.

7. RESULT

One of the objectives of this study is to design a method for real-time heart rate monitoring. This object was realized with CamShift and the processing speed was 2.7 times faster than other methods. Combining with improvement from the use of moving filter and regression analysis, the mean absolute error was 42.4% reduction from previous methods in the situation of large rapid head movement.



8. CONCLUSIONS

In this study, we have proposed a method for noncontact, real-time monitoring of heart rate even if the subject's face is always moving. We have evaluated five methods that make use of CamShift, FastICA, moving filter, and second-order regression analysis. One of the objectives of this study is to design a method for real-time heart rate monitoring. This object was realized with CamShift and the processing speed was 2.7 times faster than other methods. Combining with improvement from the use of moving filter and regression analysis, the mean absolute error was 42.4% reduction from previous methods in the situation of large rapid head movement. From experiment II, we can measure HR data similar to ECG in the situation of small head movement. Sure and thankfulness to all faculty members of the Department of Computer Engineering of Mahatma Gandhi Mission's College of Engineering & Technology Kamothe, Navi Mumbai – 400 209

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[2] In 2013, The Authors ISAYIYAS NIGATU TIBA AND LI proposed the method implements the hair cascade classifier algorithm presented in opens to detect human face. It determines on graphical interface and also image based.

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[4] In 2016, The Authors H. RAHMAN, M.U. AHMED, S. BEGUM, P. FUNK made the heart rate is obtained through facial skin colour variation caused by blood circulation. Skin colour variation are determine mean hr.

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