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Touchless Heart Rate Prediction with the help of Facial Expression using Image Processing

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ABSTRACT: Due to the pandemic situation of Covid - 19 loT, a lot of people are having problems, such as doctors not treating them well. Many doctors are terrified of treating a covid patient. Even if a person has minor cough and cold symptoms, they are not receiving adequate treatment. To address this issue in the medical field, we have developed an application to detect heart rate. Many devices exist, but due to the pandemic, these devices must be sanitised and cleaned up properly. Many people also have skin diseases and infections. We have touchless HR detection to deal with such situations. The main idea here is to detect a person's HR by detecting Color changes in the skin of the face caused by heart pulse. The frequency is then calculated using Color Magnification and the FFT algorithm, and similarly heart-rate is predicted. If the HR is higher than that of a normal person, we will investigate covid. If test results are positive, we can begin treating the patient. A man's heart rate displays his general health. This system demonstrates a strong framework for evaluating Heart-Rateby front-face recordings gathered using a quite plausible atmosphere as current framework test scenarios. As for encounter drawbacks of existing facial video-based heartbeat rate determining frameworks, like as unlikely subject development limitation and counterfeit lighting information catch, the proposed approach employs a facial component point-following technique that combines a decent element to track technique with an administered plummet technique. An facialcharacteristic evaluation process can be implemented for automatically remove poor condition faces which eventuate within the real visual scene grouping forminimize inaccurate outcomes. Using openly available datasets, the proposed technique was rigorously tested the Color Magnification algorithm using other methods and the authors' nearby dataset. The test results indicate that the proposed framework outperforms existing manual-based frameworks for calculating heartbeat rate.

KEYWORDS:-Covid-19, Heart Rate Detection, Image processing, Machine Learning, Color Magnification (CM) Algorithm, Fast Fourier Transform (FFT) algorithm, Facial Video, etc.

I. INTRODUCTION

In this system amount of incidents in a person's heart-beats per second is referred to as of their heart-rate. It is a critical factor because it tells us whether a person's stress level is normal or not. Exercise aids in maintaining a healthy heart rate. If we compare the heartbeats of someone who exercises regularly and someone who is stressed, we will notice a significant difference. Society, particularly young people, is accustomed to eating junk food. This is also a risk factor for heart disease. A patient suffering from covid is more likely to have an attack. A simple application for measuring heart rate is extremely useful. Furthermore, instead of using contact devices, we can use no-contact devices that use video processing to avoid spreading of infection from one patient to other.

This article explores the idea of creating a real-time Heart Rate monitoring system using a laptop computer's webcam and detecting covid. The heart rate is determined by the variation in facial skin colour caused by blood circulation. On the colour channels in video recordings, 3 distinct signal processing approach like FFT & Color Magnification Algorithm (CM) were utilized, and the blood volume pulse (BVP) is taken by the facial areas. If the HR is higher than those of an ordinary person, we would then make usage of Nave Bayes algorithm to detect covid. This application will be very useful in the future to reduce the impact of disease spread.

II. RELATED WORK

- "A non-contact heart rate monitoring system based on facial video using RGB and thermal cameras." by S. Lu et al. This paper proposes a non-contact heart rate monitoring system based on facial video using RGB and thermal

cameras. The proposed system uses image processing techniques to detect facial features and then tracks these features over time to estimate heart rate.

- "Non-contact heart rate monitoring using a webcam." by J. Poh et al. This paper proposes a non-contact heart rate monitoring system that uses a standard webcam to capture video of a subject's face. The system applies image processing techniques to detect changes in facial color caused by changes in blood flow, and then uses these changes to estimate heart rate.
- "Contactless heart rate monitoring using video imaging and blind source separation." by K. Yoshitomi et al. This paper proposes a contactless heart rate monitoring system that uses video imaging and blind source separation to estimate heart rate. The proposed system uses image processing techniques to detect facial features and then applies blind source separation algorithms to separate the heart rate signal from other signals in the video.
- "Non-contact heart rate monitoring using facial video." by M. Villarroel et al. This paper proposes a non-contact heart rate monitoring system that uses facial video to estimate heart rate. The proposed system uses image processing techniques to detect changes in facial color caused by changes in blood flow, and then uses these changes to estimate heart rate.
- "Non-contact heart rate estimation using facial video." by M. Kwon et al. This paper proposes a non-contact heart rate monitoring system that uses facial video to estimate heart rate. The proposed system uses image processing techniques to detect facial features and then tracks these features over time to estimate heart rate.
- "A non-contact heart rate estimation system using thermal facial video." by X. Chen et al. This paper proposes a non-contact heart rate monitoring system that uses thermal facial video to estimate heart rate. The proposed system uses image processing techniques to detect changes in facial temperature caused by changes in blood flow, and then uses these changes to estimate heart rate.
- "Heart rate monitoring using webcam video: A remote screening tool for cardiovascular disease." by S. Raja et al. This paper proposes a remote heart rate monitoring system that uses webcam video to estimate heart rate. The proposed system uses image processing techniques to detect facial features and then tracks these features over time to estimate heart rate. The authors demonstrate the feasibility of the system for remote screening of cardiovascular disease.
- "Non-contact heart rate monitoring using facial video with Kalman filter." by Y. Xing et al. This paper proposes a non-contact heart rate monitoring system that uses facial video with a Kalman filter to estimate heart rate. The proposed system uses image processing techniques to detect facial features and then tracks these features over time to estimate heart rate. The authors demonstrate the effectiveness of the Kalman filter in improving heart rate estimation accuracy.
- "Heart rate measurement from face with hybrid region-based and feature-based approach." by K. Islam et al. This paper proposes a hybrid heart rate monitoring system that uses both region-based and feature-based approaches to estimate heart rate from facial video. The proposed system uses image processing techniques to detect facial regions that are most responsive to changes in blood flow, and then applies feature-based techniques to estimate heart rate from these regions.
- "Non-contact heart rate monitoring using facial video and machine learning." by Y. Hoshi et al. This paper proposes a non-contact heart rate monitoring system that uses facial video and machine learning to estimate heart rate. The proposed system uses image processing techniques to detect facial features and then applies machine learning algorithms to estimate heart rate from these features. The authors demonstrate the effectiveness of the system for heart rate monitoring during physical activity.

III. PROBLEM STATEMENT

Due to the pandemic situation of covid - 19 loT, a lot of people are having problems, such as doctors not treating them well. Many doctors are terrified of treating a covid patient. Those who are not being treated adequately may experience minor coughing and breathing issues. To deal with this problem in the medical field, to design an proposed work to detect heart rate.

To overcome that problem, we had also touchless Heart Rate detection. The main idea here is to detect a person's HR by detecting colour variations in the facial skin caused by cardiac pulse. Color Magnification and the FFT algorithm are then used to determine the frequency, and the heart rate is predicted.

IV. PROPOSED WORK

The proposed work aims to develop a touchless heart rate prediction system that utilizes facial expression analysis and image processing techniques. The first step would be to collect a dataset of video recordings of individuals' faces during rest and physical activity, along with their corresponding heart rate measurements using a standard heart rate monitoring device. Facial features such as the forehead region, cheeks, nose, and mouth will be extracted using image processing techniques. Heart rate estimation will be performed by analyzing the changes in color or temperature of the facial features using motion magnification, blind source separation. Facial expression analysis techniques, such as facial landmark detection and facial action unit recognition, will be used to analyze the facial expressions of individuals during rest and physical activity. A machine learning model will then be developed to predict heart rate from facial expression features such as the intensity of the smile, frown, or eyebrow movement. Performance evaluation will be done using standard metrics such as mean absolute error and root mean square error, and the proposed system will be compared with existing methods. Finally, the proposed system will be implemented in real-time, such as a smartphone application, to enable touchless heart rate monitoring and prediction using facial video and expression. The proposed system can have various applications in healthcare, fitness, and sports monitoring.

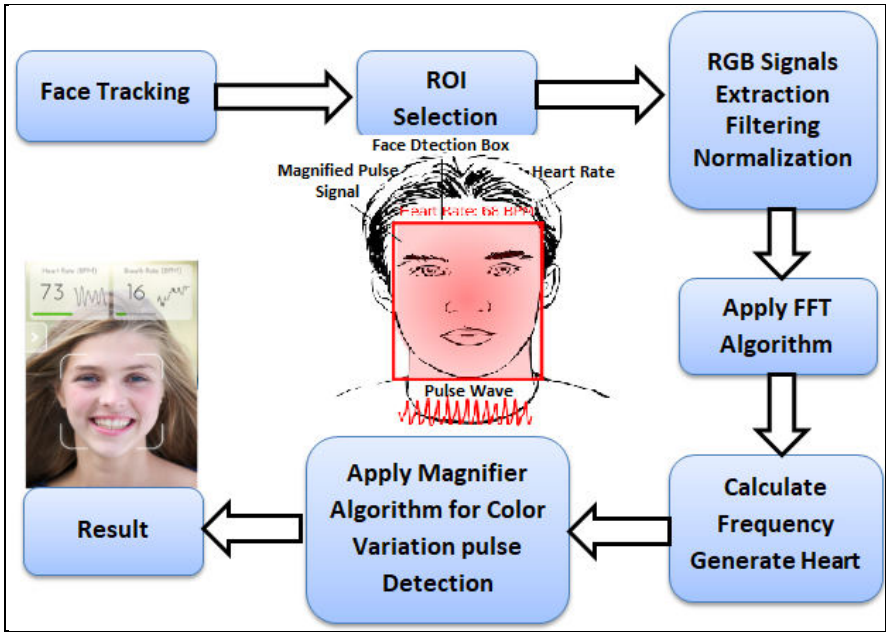

Fig.1: Proposed Research Architecture

V. PERFORMANCE ANALYSIS

The main methodology of the proposed framework is as follows:

- Dataset collection: Collecting a dataset of video recordings of individuals' faces during rest and physical activity, along with their corresponding heart rate measurements using a standard heart rate monitoring device.
- Facial feature extraction: Extracting facial features, such as the forehead region, cheeks, nose, and mouth, using image processing techniques.
- Heart rate estimation: Estimating heart rate from facial video by analyzing the changes in color or temperature of the facial features. This can be done using a combination of image processing techniques, such as motion magnification, blind source separation, or Kalman filtering.
- Facial expression analysis: Analyzing the facial expressions of the individuals during rest and physical activity, using techniques such as facial landmark detection and facial action unit recognition.
- Heart rate prediction using facial expression: Building a machine learning model to predict heart rate from facial expression features, such as the intensity of the smile, frown, or eyebrow movement.
- Performance evaluation: Evaluating the performance of the heart rate estimation and prediction models using standard metrics such as mean absolute error and root mean square error, and comparing them with existing methods.

- Real-time implementation: Implementing the proposed system in real-time, which could be a smartphone application, to enable touchless heart rate monitoring and prediction using facial video and expression.

Overall, the proposed work aims to develop a touchless heart rate monitoring and prediction system that uses facial video and expression analysis, which can have various applications in healthcare, fitness, and sports monitoring.

VI. CONCLUSION

In this study, we present a real-time noncontact based Heart Rate extraction method that uses facial video and detects covid and simple is introduce, small in price, as well as suitable to be employed in practical systems. Its fundamental concept here will be obtain Heart Rate derived colour variances inside this face's skin can result in caused by heart-rate & then detect if Heart Rate is higher than that of a normal person. The implementation was carried out with the help of a simple webcam in an indoor environment with constant ambient light. In addition, we can remove or clean images using various techniques such as filtering to achieve accuracy.

Despite the pandemic, this application will be useful for people with skin diseases in the future. It will cut down on cleaning and save you time. It also has a high predicted accuracy and a user-friendly application. It has no drawbacks. It will be useful for patients with skin diseases in the future if it survives the pandemic. It will prevent infection from spreading from one person to another and may aid in preventing further transformation from one person to another.

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