



e-ISSN: 2319-8753 | p-ISSN: 2320-6710

# IJRSET

International Journal of Innovative Research in  
**SCIENCE | ENGINEERING | TECHNOLOGY**

# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 11, Issue 5, May 2022

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

Impact Factor: 8.118

9940 572 462

6381 907 438

[ijirset@gmail.com](mailto:ijirset@gmail.com)

[www.ijirset.com](http://www.ijirset.com)



# Pulse Rate Monitoring Using Image Processing and Machine Learning

Rutuja Mulik, Kaustubh Baviskar, Mehak Bhat, Shiwani Chaudhary, Prof. Darshana Patil

Dept. of Computer Engineering, Jayawantrao Sawant College of Engineering, Hadapsar, Savitribai Phule Pune

University, Pune, India

**ABSTRACT:** Heart Rate (HR) is one of the most important Physiological parameters 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 colour 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 colour 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 degree 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.

## I. PROPOSED SYSTEM

Pulse rate is one of the most important physiological parameters to be measured in-home health monitoring system. As it is well said in English proverb "prevention is better than cure" pulse rate monitoring in our routine daily activity plays the main role in preventing an illness than to treat it. In this project, a new, low price easily accessible method to monitor human pulse rate by using PC webcam is presented. The method implements the Haar cascade classifier algorithm presented in OpenCV to detect human face. By limiting a region of interest (ROI) in the face and extracting the raw RGB trace to a video frame in the ROI, independent component analysis (ICA) is applied to determine the strongest source signal used to estimate the pulse rate in beat per minute (BPM). A graphical user interface is also designed to make this application more convenient for a user.

## II. EXTERNAL INTERFACE REQUIREMENTS

### User Interface

- The user interface must be clear, concise and comprehensive. Instead of confusing the user, the user interface must give him a clear understanding of the information workflow.
- The user interface must be easy to understand and allow the user to keep a track on the working status of the system.
- The user interface must include different elements required such as image frame, measured values etc. Moreover, user interface should be fault tolerant.

### Hardware Interface

Development Operating System: Windows

Development System RAM: 4 GB and above

Development System ROM: 2 GB HDD

Webcam: 1MP and above with proper lighting

Software Interface

Development Environment: Spyder

Language: Python

Designing Tools: Draw.io

### SYSTEM FEATURES

Realtime monitoring.

Accurate results.

Easy to maintain, upgrade and scale.

Image Processing using OpenCV.

### OTHER NON-FUNCTIONAL REQUIREMENTS

Non-functional Requirements define system attributes such as reliability, performance, maintainability, scalability, and usability. They serve as constraints on the design of the system across the different backlogs.

The proposed system must also perform up to the mark. The features and algorithms should do the required task efficiently and correctly and any malfunction must be notified immediately. The system should also be able to efficiently manage the requests made by the user.

### III. PROPOSED SYSTEM

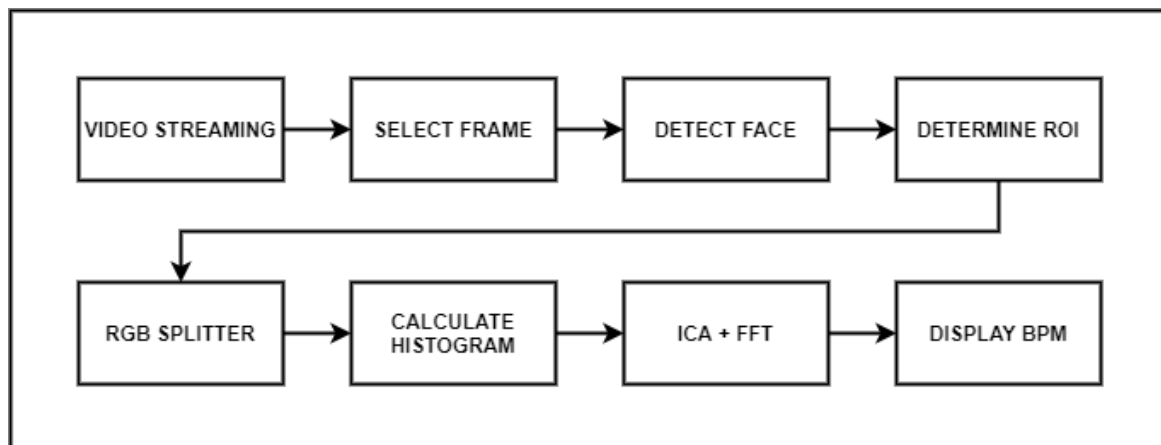
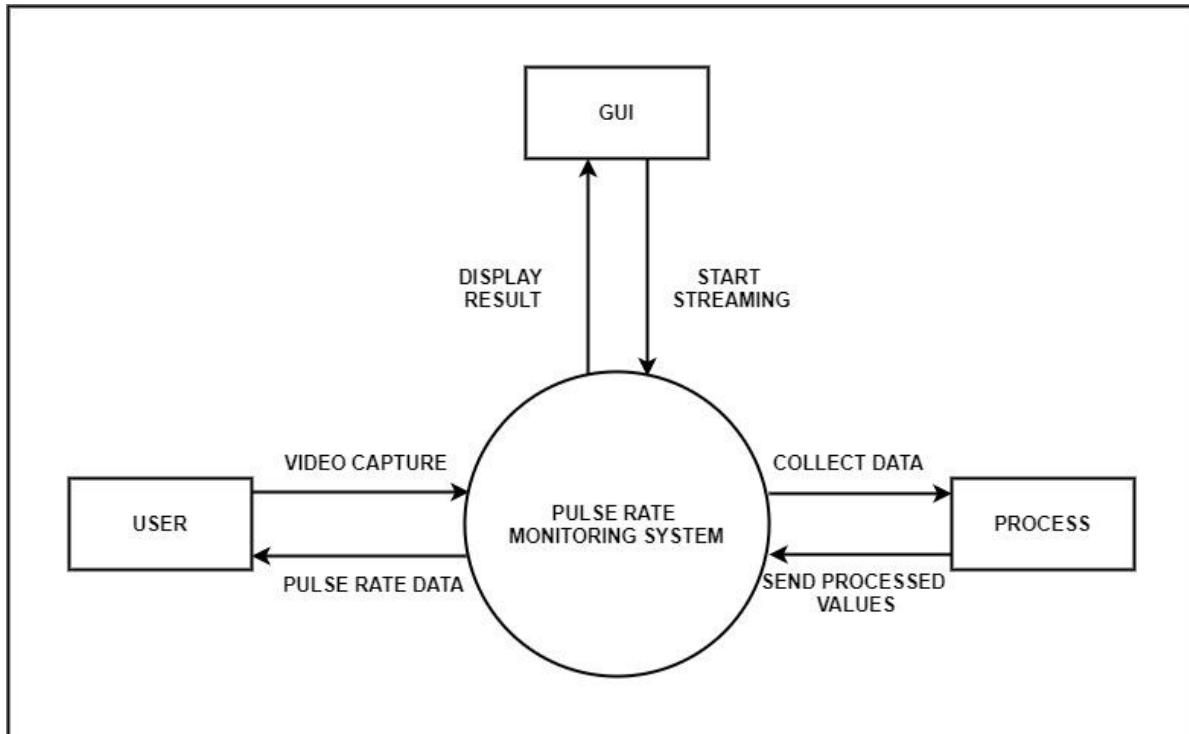


Fig. Block Diagram

Pulse rate is one of the most important physiological parameters to be measured in-home health monitoring system. As it is well said in English proverb “prevention is better than cure” pulse rate monitoring in our routine daily activity plays the main role in preventing an illness than to treat it. In this project, a new, low price easily accessible method to monitor human pulse rate by using PC webcam is presented. The method implements the Haar cascade classifier algorithm presented in OpenCV to detect human face. By limiting a region of interest (ROI) in the face and extracting the raw RGB trace to a video frame in the ROI, independent component analysis (ICA) is applied to determine the strongest source signal used to estimate the pulse rate in beat per minute (BPM). A graphical user interface is also designed to make this application more convenient for a user.

#### IV. DESIGN DETAILS

##### CONTEXT LEVEL DIAGRAM



The Context Diagram shows the system under consideration as a single high-level process and then shows the relationship that the system has with other external entities. Another name for a Context Diagram is a Context-Level Data-Flow Diagram or a Level-0 Data Flow Diagram. Since a Context Diagram is a specialized version of Data-Flow Diagram, understanding a bit about Data-Flow Diagrams can be helpful.

#### V. SCOPE & FEASIBILITY

##### Operational Feasibility

Operational Feasibility is the ability to utilize, support and perform the necessary tasks of a system such as capturing video stream, dividing it into frames, processing images etc. Since all the functions given above can be perfectly deployed hence the system is completely operationally feasible.

##### Technical Feasibility

Technical Feasibility includes the development of a working prototype of the final product. With python being the most used programming language and availability of good modules plus the strong customization options, dynamic features, good connectivity offered, implementation of the current project is very much possible.

##### Economic Feasibility

Economic feasibility is the cost and logistical outlook for a business project. We'll be using the Python IDLE which is absolutely free and open-source software. Since it doesn't require any special hardware and can be deployed on any pc or laptop with webcam; hence it is economically feasible.



## VI. CONCLUSION

A real time noncontact based HR extraction method is described in this paper using facial video which is easy to implement, low cost and comfortable for real time applications. Here, the main idea is to extract HR from the colour variation in the facial skin due to cardiac pulse and the implementation has been done using a simple webcam in indoor environment with constant ambient light. This non-contact technology is promising for medical care and others indoor applications due to widespread availability of camera specially webcams. For applications in outdoor environment for example driver monitoring, few things such as variable environmental illumination or head movement should be considered. Also, to increase the efficiency, the experiment needs to be done by more test subjects and more verifying systems.

## REFERENCES

- [1] A. Asthana, S. Zafeiriou, S. Cheng, and M. Pantic. Robust discriminative response map fitting with constrained local models. In CVPR, 2013.
- [2] G. Balakrishnan, F. Durand, and J. Guttag. Detecting pulse from head motions in video. In CVPR, 2013.
- [3] R. Basri and D. W. Jacobs. Lambertian reflectance and linear subspaces. PAMI, 2003.
- [4] G. Bradski. The OpenCV Library. Dr. Dobb's Journal of Software Tools, 2000.
- [5] G. Cennini, J. Arguel, K. Aksit, and A. van Leest. Heart rate monitoring via remote photoplethysmography with motion artifacts reduction. Optics express, 2010.
- [6] K. Chan and Y. Zhang. Adaptive reduction of motion artifact from photoplethysmographic recordings using a variable step-size lms filter. In Proceedings of IEEE on Sensors, 2002.
- [7] F. X. Gamelin, S. Berthoin, and L. Bosquet. Validity of the polar s810 heart rate monitor to measure rr intervals at rest. Medicine and Science in Sports and Exercise, 2006.
- [8] M. H. Hayes. 9.4: Recursive least squares. Statistical Digital Signal Processing and Modeling, 1996.
- [9] K. Humphreys, T. Ward, and C. Markham. Noncontact simultaneous dual wavelength photoplethysmography: a further step toward noncontact pulse oximetry. Review of scientific instruments, 2007.



**Impact Factor: 8.118**



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 **9940 572 462**  **6381 907 438**  **ijirset@gmail.com**



[www.ijirset.com](http://www.ijirset.com)

Scan to save the contact details