



Heartrate Monitoring System Using Webcam, Arduino Uno, Mobile Application

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Abstract—In this current crisis of COVID 19 pulse detection is at most important stage. This research paper majorly focuses on pulse detection and its application in most commonly used electronical devices 1) Web cam pulse detector: It focuses on pre-frontal lobe (i.e. forehead region) to measure the optical intensity which is responsible for pulse measurement. It uses OpenCV for face detection and python for programming/coding. 2) Arduino implementation: It monitors 6heartbeat(pulse) at fingertip using technique of Infra-Red waveforms and corresponding the digital pulse readings are displayed. Capacitive scanner is used to detect fingerprint and programming language used was C/C++. Heart rate monitor android application: It uses phone's front camera to detect the color transformation on fingertip which measures pulse rate. The app is implemented and processed on Android Studio.

Keywords—Webcam, Arduino, Android

I. INTRODUCTION

Due to the current COVID19 crisis the numbers of patients have increased as compared to limited seats availability in hospitals. So, the importance of home health monitoring system has increased as this epidemic is very dangerous. Due to the symptoms like low pulse rate and difficulty in breathing the measuring of pulse rate has become of utmost importance. In this research paper the Web cam pulse detector and Arduino implementation is thoroughly studied. The pulse detector uses web cam of personal computer for image processing and calculating heartrate/heartbeat in (BPM) at home. The heartbeat is measured depending on various factors like PPG (Photoplethysmography) an optical technique implemented using dedicated light sources like

LED (Light emitting diode) and IR (Infrared) rays depending of color transformation and specific wavelengths the blood oxygen saturation and blood volume pulse (BVM) is detected by recording human face using OpenCV and fingertip to obtain the pulse rate of non-contact surface (i.e. heart) by proper image processing.

The fitness level of a person is determined by BPM which is (100-160) for Babies and (60-100) for Adults it varies between children and athletes. It's costless and a novel methodology for calculating pulse rate for cardiovascular and COVID19 patients at home. It records the undergoing different intensities to measure assessments on basis of physiological conditions of a person. As Lightheadedness, Chest pain, Dizziness, low breathing is determined. In Arduino implementation the main property is measuring the ratio of Red light to that of infrared light passing through a person's finger as it produces a signal proportional to level of oxygen in blood and the blood volume in each heartbeat determines the pulse rate of a person.

II. METHODOLOGY

System Architecture:

We are using an inbuilt webcam, in order to test the application, device is placed in a way that non-contact surface of human body is captured for few seconds. The normal distance required in between the device and the human body can be around 100 cm. An ambient IR green light will be formed on the forehead of the human body. Here person is tested in the presence of natural light in the room with all equipment's positioned correctly. During contraction and expansion of cardiovascular events, there will be changes in the facial blood vessels below the skin which further lead to change in the path length of reflected ambient green light. These facial volumetric changes are recorded by the webcam and processed using RGB color pick up sensor with all fluctuations recorded during the event

This testing is conducted in the normal sunlight present inside the room which varies frequently. Here person is asked to sit in a way that his forehead is captured by the webcam, and he is set free to breath normally without any gasping. The video will be captured for a while so that every minute changes in the path length are recorded as they are. This video will be processed using OpenCV Which is computer vision process, which helps in understanding images and videos, like how they are stored, and how they are used to retrieve data. This is an AI enabled computer vision process which is frequently used for image processing. This is used as it plays a major role in real time operations which is very important in these modern days. It recognizes the forehead and helps in capturing the path length of blood vessels present below the skin, and those path lengths are changed into PPG signals. These waveforms help us to calculate the heartbeat of a person, and results are displayed on the console.

Web cam pulse detector: We are using an inbuilt webcam, in order to test the application, device is placed in a way that non-contact surface of human body is captured for few seconds. The normal distance required in between the device and the human body can be around 100 cm. An ambient IR green light will be formed on the forehead of the human body. Here person is tested in the presence of natural light in the room with all equipment's positioned correctly. During contraction and expansion of cardiovascular events, there will be changes in the facial blood

vessels below the skin which further lead to change in the path length of reflected ambient green light. These facial volumetric changes are recorded by the webcam and processed using RGB color pick up sensor with all fluctuations recorded during the event.

Arduino: It is a microcontroller that works along with the sensor. When placed finger on the sensor, It reads the movement of blood vessels present below the skin and turn them into output by calculating their wavelength, which further displayed as beat per minute (BPM) on the console present on the Arduino.

Design of sensor:

Web cam pulse detector: This testing is conducted in the normal sunlight present inside the room which varies frequently. Here person is asked to sit in a way that his forehead is captured by the webcam, and he is set free to breath normally without any gasping. The video will be captured for a while so that every minute changes in the path length are recorded as they are. This video will be processed using OpenCV which is a computer vision process, which helps in understanding images and videos, like how they are stored, and how they are used to retrieve data. This is an AI enabled computer vision process which is frequently used for image processing. This is used as it plays a major role in real time operations which is very important in these modern days. It recognizes the forehead and helps in capturing the path length of blood vessels present below the skin, and those path lengths are changed into PPG signals. These waveforms help us to calculate the heartbeat of a person, and results are displayed on the console.

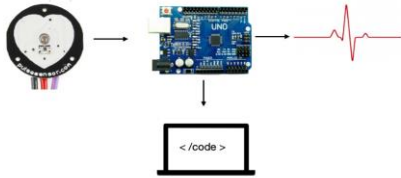
Arduino: It calculates the heartbeat of a person using a sensor and it is programmed using C/C++, it calculates the cardiovascular event happening inside the finger, it uses infra-red waveforms to calculate pulse of a person and it displays the digital pulse reading on the console. It basically changes mechanical waves formed by the movement of blood vessels below the skin to digital waves

III. RESULTS

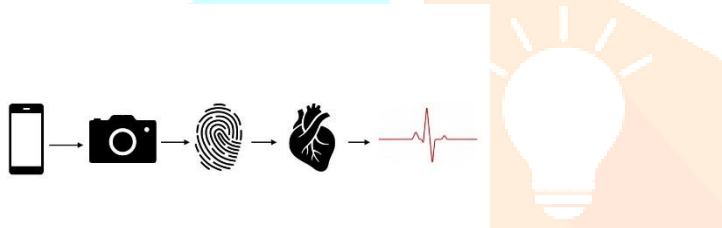
The Web cam pulse detector, Arduino Implementation and Android app for pulse detection is successfully executed as the expected output defines the accuracy of it's working. The complete analysis of PPG signal is portrayed as the pulse rate is detected by LDR amplified rays and displayed on output (LED), Digital display etc. The average pulse calculated validates the heartrate of person. However, the rate may vary from person-to person depending on multiple factors. The pulse sensor and microcontroller working is monitored as outcome is acquired.



Using Arduino Pulse Detection -



Pulse Detection Using Android Application –



IV. DISCUSSION

As the IR light is focused on non-contact surface pre-frontal lobe (the forehead region) the web-cam captures the VI image and stores it for the detailed analysis. The processed video imaging displays the color histogram and PPG signal variations. The sensor setup for Arduino is connected by a power source. The red light LDR amplified passed through the finger (fingertip) shows the color transformation. For mobile devices the finger is placed on the camera for detecting pulse.

V. CONCLUSION

Pulse measurement using [Arduino and Web cam pulse detector] is quite easier as it's got multiple applications. Detection of COVID 19 +ve patient's symptoms by proper analysis and observation of unusual pulse rate and hint of oximetry characteristics.

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