

# Emergency Pulse Rate Monitoring and Detecting the Location of Handicapped People

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## Abstract

The wearables have long been used in the healthcare sector, for example in hearing aids, in detecting health disorders such as sleep apnea and in detecting the blood pressure etc. As smartphones have become one of the necessary gadgets of our daily life we can use its potential to develop an application with the help of these devices to make the system easily wearable and mobile. This project describes the Android Application Which will continuously monitor the pulse rate of the user & collect the data. This data will be sent to the nearest people in the form of the text message as well as alarm generation just by pressing the smartphone screen for few seconds. This message will contain the pulse rate details and also changes in the location of handicapped people so that further emergency actions will be taken. The KNN algorithm will be used to find out the nearest people of the user. This system will be developed considering the handicapped people.

**Keywords-** (K Nearest Neighbors) KNN, (Global Positioning System) GPS, Photoplethysmography (PPG)

## I. INTRODUCTION

A person's heartbeats play a vital role in detecting his/her physical as well as emotional condition according to situations [2]. 'The heartbeat' is nothing but the sound of the valves in the heart contracting or expanding as they circulate blood from one region to another and 'the number of contractions by the heart per minute(bpm) is 'heart rate' which is also known as 'pulse rate.' It can be checked at the wrist by placing two fingers between the bone and the tendon over the radial artery. Hence nowadays so many systems are used for continuous monitoring of patients who make the use of various wearable sensor devices to calculate the pulse rate [2]. These sensors are available in various forms like clothing, wristwatches, and chest straps etc.

A lot of work has been done to enhance the medical facilities but there is always a scope for further progress. This technology can be used to help people with certain disabilities. In an emergency situation a handicapped person is unable to move or give any immediate reflex to the situation Also it is very hard for a deaf and dumb person to communicate or give any signal to others in any difficulty. In such cases, we can help these kinds of people by using this technology [5]. Also nowadays smartphone has become important for everyone. So we can add new features to help such disabled people [1]. So our main focus is to study and develop the application for heart rate monitoring and detecting the location of handicapped people.

The rest of paper is organized as follows. Section II contains the related work that has been performed, section III consists of the motivation behind this study, sections IV and V describe our proposed work and advantages, disadvantages respectively. Section VI contains the conclusion of the whole study.

## II. RELATED WORK

| Ref. No. | Technique used   | Advantage   | Disadvantage  |
|----------|--|---|---|
| [1]      | This paper used Photoplethysmography to calculate heartbeat, it uses 'Health Kit Store' to process the collected data. This data is accessed by SOS Heart app. | Not only medical issues but this paper also finds user's location. Apple watch used gives many accurate readings. | The technique used in this paper is only on Apple watch and iPhone. |
| [2]      | A Heart Beat (HB) sensor is being developed for acquainting the input signals using Light Dependent Resistance (LDR) and Light Emitting Diode (LED)            | The proposed model is much more precise, straightforward and cheaper than other heartbeat rate measuring systems. | It's Totally hardware system  |

|     |   |  |   |
|-----|---|--|---|
| [3] | <p>1) Person tracking- Each person is tracked and segmented.</p> <p>2) Attribute-based multi-gait model- A new latent conditional random field (L-CRF) model is constructed to discover the stable multi-gait features.</p> <p>3) Attribute detection- The attribute set of a new multi gait sequence is detected by inferring on the model. After detection, classification can be completed using the detected attributes.</p>  | <p>The experimental results demonstrate that the proposed method achieves better recognition performance than traditional gait recognition methods under the condition of multiple people walking together.</p>  | <p>1) they are not capable of representing the complete pool of all classes, and</p> <p>2) They are not able to capture the inherent intra-class variability of each class.</p> |
| [4] | <p>Digitally sensing body temperature and heart rate using Arduino.</p> <p>The device will allow one to measure their mean arterial pressure (MAP) in about one minute and the accurate body temperature will be displayed on the Android.</p>  | <p>Multi-gait Recognition based on Attribute Discovery</p>   | <p>This system is hardware platform and also required more time</p>   |
| [5] | <p>A wearable system for heart rate monitoring based on photoplethysmography (PPG).</p> <p>This method based on sensing the cardiovascular pulse presents the analyzing of the light variations on biological tissues and can be useful for wireless patient monitoring consequently ambient assisted living applications.</p>  | <p>This method based on sensing the cardiovascular pulse presents the analyzing of the light variations on biological tissues</p>  | <p>It is cumbersome to maintain a huge set of records.</p>  |
| [6] | <p>1. Data Sampling &amp; Segmentation-Real data is collected for a sequence of daily activities using wearable motion sensors &amp; transmitted to a laptop/ computer where all the data was stored for off-line data processing and algorithm development.</p> <p>2. Feature Extraction &amp; Selection-After data segmentation, an exhaustive set of statistical and morphological features are extracted from each data segment.</p> <p>3. Localization &amp; AR-Node localization technique automatically discovers the on-body location of medical monitoring devices using acceleration and angular velocity data.</p> | <p>Our approach achieves localization accuracy of 90.8% even when the sensor nodes are miss-oriented.</p>  | <p>It leads to wastage of Resources.</p>  |
| [7] | <p>The device measures PTT (Pulse Transit Time) which is then converted to BP using appropriate fitting functions. They also proposed a unified method to train, develop and calibrate PTT-BP equation to each individual and posture.</p>  | <p>In this work, we investigate various functions to perform the training to obtain blood pressure. We validate measurements on different postures and subjects and show the value of training the device to each posture and each subject.</p>                | <p>Here are lots of confusion to handle this resource and calculations are complex.</p>   |
| [8] | <p>FPGA (Field Programmable Gate Arrays) kit has been taken as a central processing unit. The result so calculated is then transmitted serially to a Bluetooth module via UART communication Protocol. Bluetooth module will transmit the result to SMART phone</p>   | <p>This paper describes the development of a System-on-a-chip (SOC) based wearable system for the measurement of Blood Pressure that will act as CNBP system enabling the doctor to clearly analyze a patient's blood pressure changes throughout the day.</p> | <p>This system only measures the blood pressure</p>   |

### A. Analysis

The above survey table shows that various SOC based systems are developed using Arduino, FPGA (Field Programmable Gate Array) and beagle bone platforms which can measure the heart rate as well as body temperature digitally. It calculates the mean arterial pressure (MAP) in about one minute and data is displayed on the Android. In some other systems, photoplethysmography (PPG) technique is used for detecting the changes in blood volume caused by pressure where a skin is illuminated with the light from LEDs to take the input. 'Apple Watch' can be the best example of this technique and it is the only smartphone application which is able to recover the raw data from Apple Watch's Health Kit and automatically send it to the emergency department or physician's office when abnormal heart rate occurs.

But there are so many challenges as well in these pulse rate monitoring systems. Miss orientation of sensor localization can affect a lot the accuracy of output. The GPS, Bluetooth, and ZigBee can be used to send the alert messages on the smartphone but they also have the limitations of good internet connection, limited meter range etc.

## III.MOTIVATION

The wearable systems which are developed have so many advanced facilities but there is the huge scope of further developments like interfacing the system with a computer to display the heart rate on the computer, low power consumption for optimization of resource allocation, the application which sends continuous alert messages at certain time interval etc. Most of the existing systems

work on GPS for outdoor location detecting but it provides accuracy up to 20 meters only. So we can work on these and many more issues to make the systems more efficient and reliable. So the limitations of existing systems are the great motivation behind this work. Hence our main goal is to develop the system which can be useful for sending indoor as well as outdoor alert messages just by touching the screen of smartphone which will save the time also. These facilities will be developed considering elderly or person with physical disabilities or patients that might be unconscious during a medical emergency at a cheaper rate.

#### IV. PROPOSED WORK

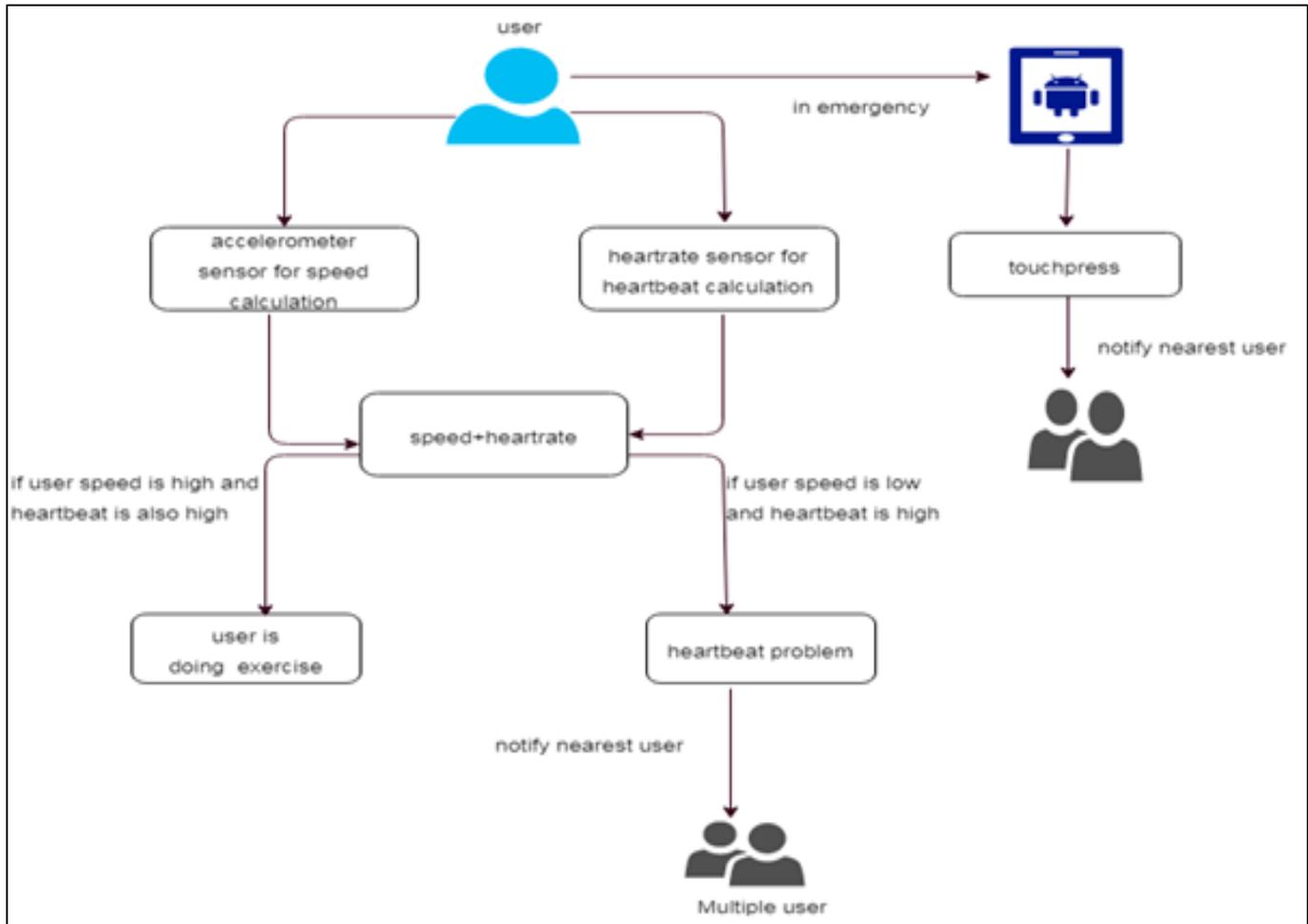


Fig. 1: Structural Diagram

The above diagram gives the complete structure of the system where a user has to register himself/herself on Android Application and connect the band via Bluetooth. This application will be developed in Eclipse, Android Studio in JAVA/J2EE language. Then system keeps taking the pulse rate & location details. This data will be stored in MySQL database and it will be checked to the default parameters.

Three modules of the system are-

- A. Heart rate
- B. GPS and
- C. Touch pressure

Whenever the person will feel abnormal or weird he/she just need to touch the smartphone screen for certain time period and then an alert message will be sent on the mobile numbers which are saved on the device with person's health information. The detailed working of system and algorithm is given below-

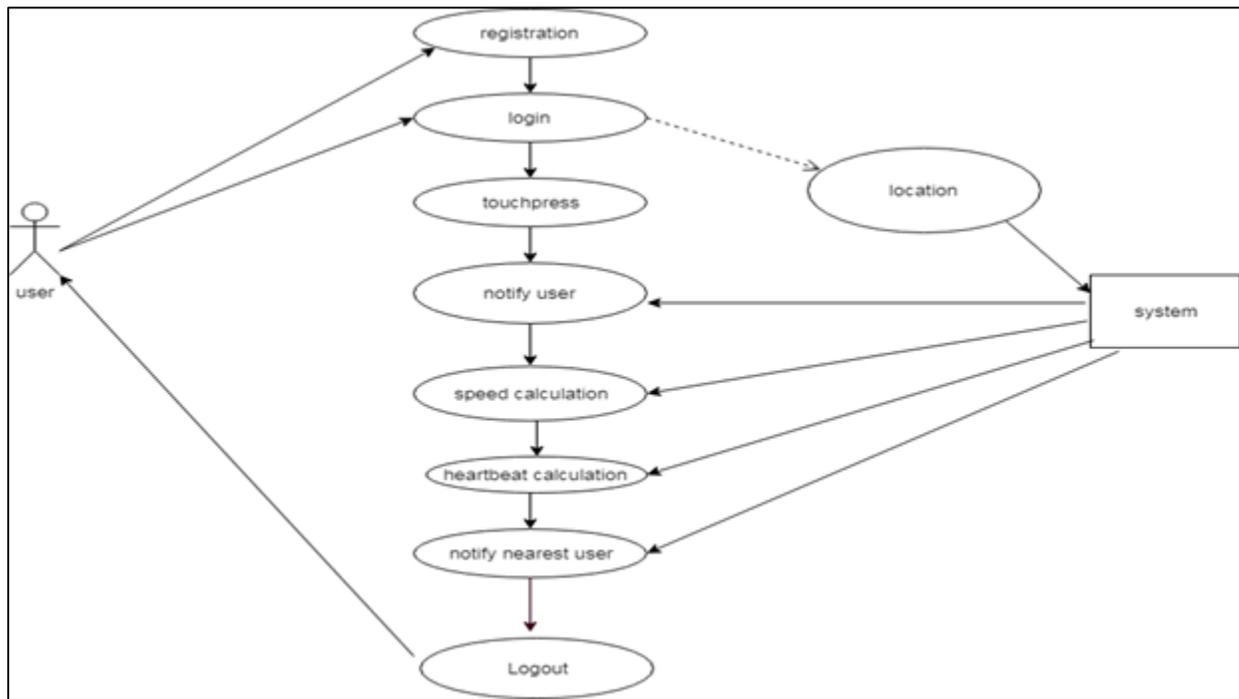


Fig. 2: Use Case Diagram

### A. Heart Rate

A wristband is used to calculate the pulse rate of the person which is connected to the user's smartphone via Bluetooth. The smartphone application will store all the health-related information of a user, phone number of relatives, police station and doctor. Two conditions will be checked while pulse rate monitoring –

- 1) The user is stable and the heart rate is fast and
- 2) The user is moving and heart is also fast.

### B. GPS

There are two facilities to show the emergency. One is to send an alert message via GPS (Global Positioning System) and second is to make alarm notification for nearby people. If the position of the user changes that is away from specific limit then the message will be sent to the police station. The process of sending alert messages is done by using KNN (K Nearest Nodes) algorithm. It is possible after measuring the Euclidian distance i.e. the distance between two points in Euclidian space. It is given by-

$$d_E(x, y) = \sum_{i=1}^N \sqrt{x_i^2 - y_i^2}$$

Where,

$X_i$ =longitude

$Y_i$ =latitude

The accelerometer in the smartphone will calculate the longitude and latitude to know the exact position of the user.

### C. Touch Pressure

The user just needs to touch the smartphone screen for a specific time period to send an alert message and this will be the uniqueness of our system.

## V. SYSTEM UTILIZATION

The main benefit of our application is touch time saving and making user's task easier with the help of touch pressure. Secondly, an instant alarm message will be generated for indicating emergency to the nearest people.

## VI. CONCLUSION

The application can be used for continuous pulse rate monitoring, detecting the indoor as well as outdoor the location of the user & feature of sending an alert message to the nearest people. But variations in on-body sensor locations and gait phases can affect the expected outcomes. There is future scope to increase the accuracy of speed and distance measurement as well.

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