Patient BBIs Monitoring System and Movement Analysis using Machine Learning Techniques and IoT

V. Kovendan[a] , V.M. Janani[b], M. Rasmee Baseera[c], T. Sangeetha[d]

[a]Asso.Prof , Department of CSE, Arasu Engineering College, Kumbakonam
[b]Bachelor of Engineering,Department of CSE, Arasu Engineering College, Kumbakonam

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Abstract: Wireless technology has been developed for different medical fields. The pulse monitoring system is used and in some private medical places only recorded and not utilized properly. However, accessing large medical equipment is inconvenient and expensive. In this, The proposed real-time heart rate monitoring system extract the heart beats measurements and that is stored and retrieved via Arduino microcontroller which connects the heart rate to the internet and sends results to the web server and notifies it to the specialist. Zero crossing in the resulting filter bank output signal represents heart rates that are extracted from BBI's. The obtained heart rate is classified using the algorithm to denote the condition of the patient to notify it to specialist. Finally, the HRV features are calculated from the extracted BBI's. If any risk found, it sends the emergency alert notification to the specialist. This system also monitors the patient activity in case of any emergency of patient using the IR sensor connected to the Arduino micro controller which alerts the controller or the specialist by a buzzer. The proposed framework isn't just utilized by the trained professional yet additionally by different clients (User agreeable). It offers speed and exactness in outcomes and with negligible expense. This technique is planned a Heart Rate Monitor System utilizing Arduino and Heartbeat Sensor. The exhibition results are contrasted and ECG signal addressed by oscilloscope and manual heartbeat estimation of heartbeat rate, which gives great arrangement.

Keywords: Heart pulse, IR sensor, HP sensor, Arduino board, HRV, Emergency alert.

1. Introduction

Patient monitoring system is used on recent technology with various adaptations of algorithms and approaches that causes us to screen tolerant in any event, when the patient isn't in the hospital. This builds admittance to wellbeing administrations and offices while diminishing expense. Distance based Patient Monitoring spares season of both patient and specialist, henceforth expanding productivity and dependability of wellbeing administrations. Pulses are frequently checked with the heart contracts and unwind in a unit of time. For a human grown-up old enough at least 18 years, an ordinary resting pulse is around 72 beats for every moment (bpm). The working of heart can be called as powerful in case it is having lower heartbeat when the patient is still. Newborn children have significantly higher rate than adults around 120 bpm and more prepared adolescents have heartbeat around 90 bpm. In the occasion, the beat is lower than the run of the mill beat, it implies that a condition known as bradycardia and if the beat is higher than the conventional heartbeat, it implies that a condition known as tachycardia. Like pulse, ordinary internal heat level additionally differs from individual to individual and changes for the duration of the day. The internal heat rate is most reduced in the early morning and most noteworthy in the early night.

Multi boundary checking framework is utilized for observing various basic physiological indications of patients by sending the indispensable data like ECG, pulse and circulatory strain, etc. Because of these reasons, multi boundary tolerant checking frameworks assume a critical part in the field of clinical gadgets. The producer is essentially an IR LED and the locator is basically an IR photodiode that delicates to IR light of a similar frequency as that transmitted by the IR LED. At this point, the IR light falls on the photodiode, the protections and the yield voltages will change with respect to the maximum utility of the IR sensor. This infrared sensor circuit is an electronic device, which transmit and receives the IR signal.

The Arduino board is related with the heart beat sensor, as of now resulting to completing the microcontroller and sensor arrangement the board should be related with a force source. Since here we use consecutive correspondence for showing the result or the perceived heartbeat, we are interfacing the microcontroller with the PC through the USB port. By and by the program is accumulated and moved into the Arduino board using Arduino compiler and the result is appropriately gained in the consecutive screen of the supposed compiler and moreover the BPM is resolved.

The perceived information can be dealt with wanted sheet with the assistance of PLX-DAQ contraption and we will change over the straight qualities from the heart beat sensor into BPM respects with the assistance of java code. At long last, we can login into the online area where in the expert module a professional can login and see the patient's data. In the patient's module, the patient can login and give his/her uneasiness portrayal and send the BPM. The sensor is then interfaced to a smaller than expected controller that licenses checking beat readings and conveying them over web. The client may set the high also as low segments of heart beat limit.

IR LEDs are regularly made of gallium arsenide or aluminum gallium arsenide. In supplement with IR gatherers, these are typically used as sensors. The presence of IR LED is same as a common LED. Since the

normal eye can't see the infrared radiations, it isn't doable for a person to recognize if an IR LED is working. A camera on a PDA camera handles this issue. An IR sensor includes two areas, the maker circuit and the recipient circuit. This is through and through known as a photo coupler or an optocoupler. The maker is an IR LED and the identifier can be the IR photodiode.

2. Literature Survey

2.1 Smart Wearable's in the Application of Fitness X. Wang – 2017:

The smart wearable device n various applications are reviewed to get the better algorithm. For example, in the clinical consideration industry, experts can use wearable tech to look inside a patient's veins there and a while later, without keeping things under control for breadths or X-radiates. wearable development presents a ton of interferences.

2.2 Accelerometer sensor fusion for fitness monitoring M. N. S. Zainudin -2017

The phone based movement recognition model uses low-pass channel and a mix of Multilayer Perception. The information was recorded from four volunteers while performing six exercises: slow running, quick running, strolling, oxygen consuming move, steps up and steps down. Clutter and privacy concern are the drawbacks of a vision-based sensing system. Computational expensive and limitation of portability is considered as the disadvantages of the sensing system.

2.3 Human-computer interaction for sensor based fitness application A. Ancans -2017:

A survey investigation on BCI in VR from various perspectives, including Electroencephalogram based BCI models, AI, and current powerful stages. Considering our assessments, the guideline disclosures of this outline include three huge headway examples of BCI, which are entertainment, VR, and disseminated figuring. The current BCI VR investigates from three pivotal angles that are EEG-based BCI models, AI, and stages.

2.4 Improving patient safety and clinician workflow using surveillance monitoring:

The framework comprising of 9-hub inertial estimation unit and electromyography sensors was proposed and a remote headband model was created to quantify framework execution and contrast it and comparable examinations. Regardless of the clinical advances, some degenerative illnesses this influence individual development, as amyotrophic horizontal sclerosis (ALS), different sclerosis, Parkinson's infection or cerebral paralysis actually can't be restored.

3. Conventional work

Today's technology, pulse observing is kept up in emergency clinics and utilized in numerous public just as private spots and so forth In the event that moves can be made before on schedule, loads of patients can be relieved. In any case, admittance to a significant number of clinical gear is awkward and costly. The crude clinical information kills a lot of time and may raise a ruckus. It is extremely hard to share information over a huge territory inside a brief period.

4. Proposed System

Our method uses a pulse sensor, Arduino board to find heart beat rate. Pulse sensor starts sensing heart rate readings and displays the heartbeat of person on LCD screen. If patient have issue in heartbeat, the sensor sends the notification to the specialist. And also, patient give any emergency alert to the controller. It is low of cost when contrasted with other sensor types. It is a minimized gadget which we can take it to elsewhere. It is not difficult to utilize and any individuals can deal with it.

5. Problem Statement

Time efficient patient monitoring system has a visit to clinics for a heart checking finding. The advancement for interfacing and separating ECG leads from individuals to individuals is squandering a great deal of times. Also, there is a danger of disease while connecting the wires on the assemblage of patients. This paper will zero in on the best way to build up an easy to use coronary illness observing gadget that ready to identify the chance of an individual experienced with coronary illness. An ease, lightweight and dependable gadget is proposed to recognize the heartbeat and beat of the patients continuously premise dependent on computation. The proposed framework can associate with the cell phone remotely by utilizing Bluetooth convention to expand the versatility of the patients.

6. Implementation

6.1 Device Initialization Module

In this module, we initialize the circuit with sets of DAC input/output pins and using sensors to analyze the signals. A buzzer or beeper is a signaling device, used to alert the specialist and care taker. IR Sensor recognizes the activity of patient to give alert and a pulse sensor for measuring the heart rate variability is initialized in arduino board.

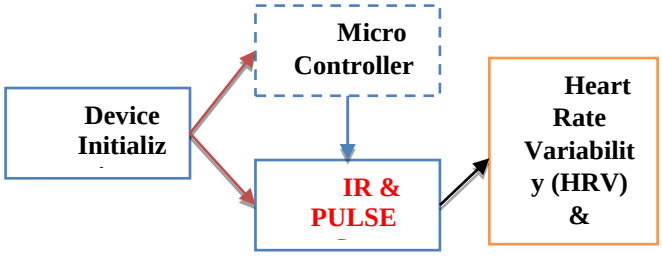

Figure 6.1. Initializing the IR Sensor and Pulse Sensor

6.2 Monitoring Module:

The objective of this module was to empower the use of straightforward engineering and low force sensor for continuous and quick single individual HRV extraction, which is reasonable in applications, for example, medical services checking, rest observing. CW utilize a solitary recurrence wave tweaked by the objective's development, which makes them skilled for checking relative uprooting as it were. High-precision observing of the pulse fluctuation (HRV) highlights is needed in various applications.

Figure 6.2. Analysing Data of Heart Rate Monitored

6.3 Data Analyse Module:

The time space examination to precisely assess BBIs progressively and to figure HRV highlights. The information investigation utilized for coarse assessment of the pulse recurrence and the narrowband band pass sifting for additional refinement. The recurrence examination of brief timeframe windows are empowering further HRV investigations.

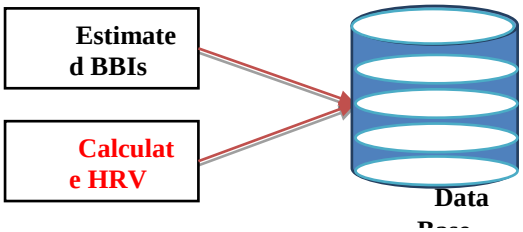

Figure 6.3: Estimation of BBIs in Real Time and Calculate HRV Features

6.4 Alert Module:

In this module, if there is any risk found in patient movement, that can be acquired by the IR sensor and it sends the emergency alert notification to the specialist. The analysis of this input can be done using the classification SVM algorithm from the trained data sets. And if it found the patient movement to be an abnormal then it will be considered as an emergency situation, based on that alert to the controller by using sensor will be given.

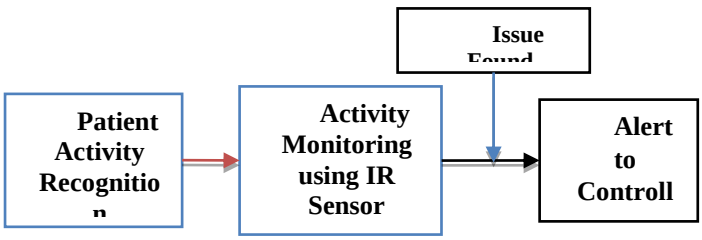

Figure 6.4: Activity Recognition Through IR Sensor and Alert to Controller

6.5 Connecting to Cloud

In this module we connect our system to store all the data to the cloud to upload the Heart Rate details. So that user can access the data for future reference and for any a emergency situation the specialist can get the detailed report of the patient to give the appropriate solution.

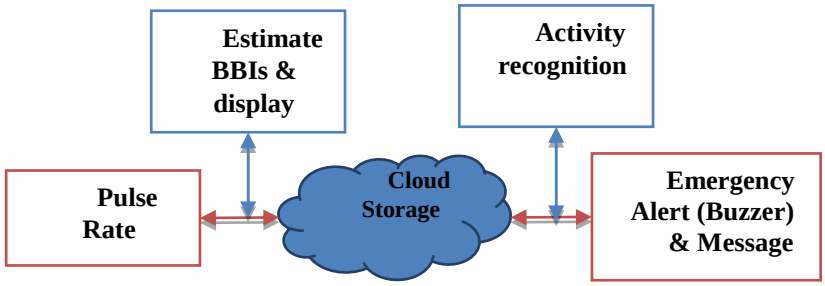

Figure 6.5: Store and Retrieve Data & Information in Cloud

7. System Architecture

The pulse sensor starts sensing heart rate and displays the heartbeat of person on LCD screen for each and every second, and average rate for an hour will be stored in the cloud storage provided for the patient shown in figure 7.1. If patient have issue in heartbeat, the sensor sends the notification to the specialist. It is a compact device which we can take it to anywhere else and simple to handle.

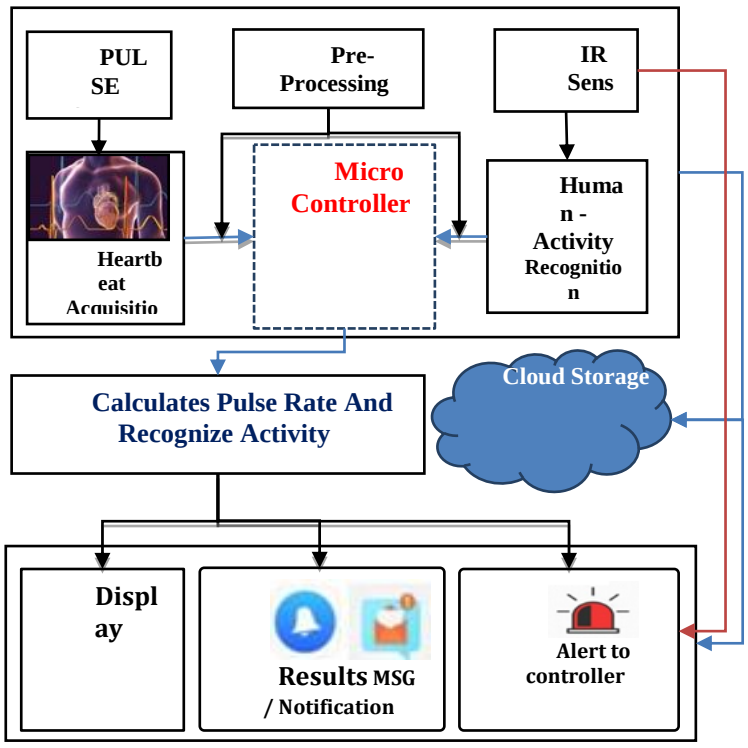

Figure 7.1: The System Architecture of HRM and HAR

8. Results

The model is utilized for testing the calculation execution within the sight of commotion and I/Q lopsidedness in a few distinct situations. All calculation boundaries in those tests are set to values portrayed in the impact of commotion on calculation precision.

Table 1. Describes Beat to Beat Time Interval, And Calculated Heart Beat Rate

Beat to beat interval (in hours)	Heart beat per minute	Activity recognition	Risk Factor
1	165	0	High risk
2	117	1	Low risk
3	116	1	Low risk
4	102	0	Normal
5	101	1	Normal
6	160	0	High risk
7	72	1	Normal
8	90	1	Normal
9	99	1	Normal
10	32	0	High risk
11	105	1	Normal
12	111	1	Low risk
13	120	1	Low risk
14	27	0	High risk
15	28	1	High risk
16	86	1	Normal
17	94	1	Normal
18	100	1	Low risk
19	112	0	Low risk
20	77	0	Normal
21	83	1	Normal
22	106	1	Low risk
23	92	1	Normal
24	97	0	Normal

The result acquired from the devices that are stored in cloud storage, shown in the table 1. provides the beat to beat time interval and calculated as HBR. This influence is tested for a sample of 24 hours of different heart rates (HR).

Table 2. Describes the Reference Values of The Heartbeat Rate

Heart beats	Activity recognition	Risk level
Below 50	No action/idle = 0	High risk
Between 50-150	No action/idle = 0	Low risk
Between 50-150	Action = 1	Normal
Above 150	Action / no action/idle = 1/0	High risk

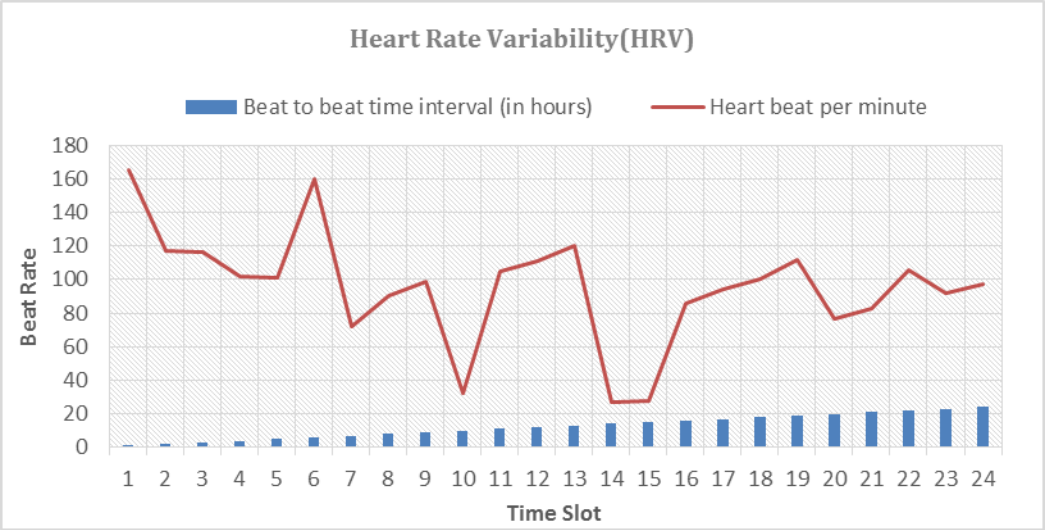

Figure 8.1. Calculated Beat Rate Average Per Hour

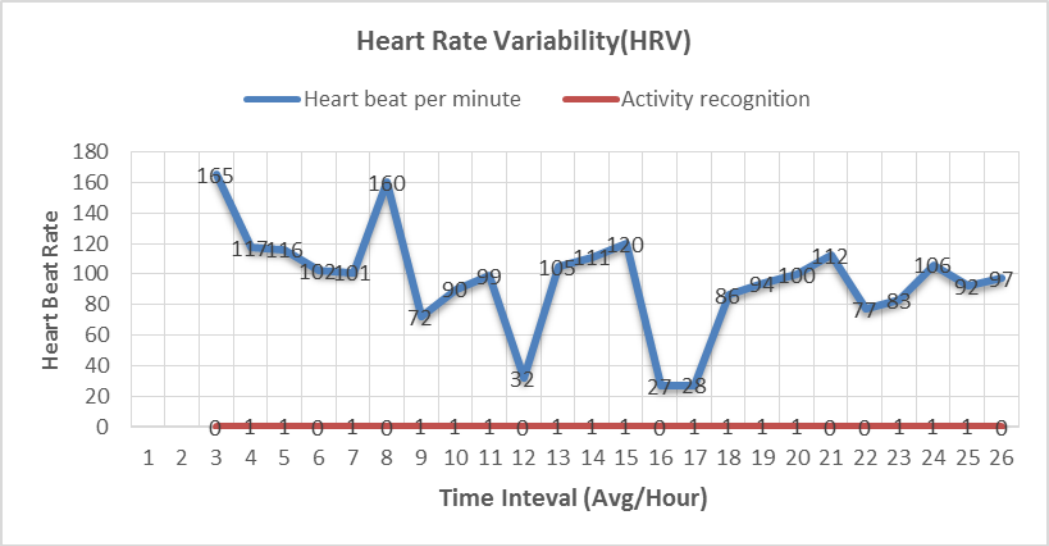

Figure 8.2. Activity Report Based on HRV

9. Conclusion

The real-time applications based proposed method offers a minor delay from the occurrence of the heart-beat while waiting for its detection (~ 2.5 s). By using the senor, it predicts the patient Heart bit rate based on the time interval it stores the result in cloud and retrieve the analysed output whether the patient condition is normal are at risk. If the reference value to be found abnormal, immediately it sends the emergency alert notification to the specialist. This makes the patient to monitor each and evey time interval with the calculated mean value. The cloud DB stores all the acquired and recognized values for the future references to reproduce the patient details when required. Improved accuracy rate of BBI extraction enables the HRV features in the medical field, leads to provide better solution to monitor and prevent the patient.

9.1 Future Work

In future, the radar receiving wires with higher directivity and use them for radars with considerably higher frequencies than 24 GHz to get better outcomes. Higher directivity receiving wires would identify less irregular body developments, in this manner giving better mistake execution.

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