International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 04 | Apr-2018 www.irjet.net p-ISSN: 2395-0072

# HEART LIFE: A HEART BEAT MONITORING SYSTEM USING IOT

**Ashwin M[1], Githu Jeeva Savy[2], Moncy Puthenpurackal Mody[3], Neethu Subash[4]**

[1,2,3,4] *Computer Science and Engineering Department,*
*Mar Athanasius College of Engineering, Kothamangalam, Kerala, India*

---

**Abstract -** *Presently health problems including cardiac failures and heart related diseases are increasing day after day at a very high pace. Due to these problems time to time heart monitoring is very essential. A modern concept is heartbeat monitoring of a patient wirelessly. It is a major development in medical arena. The system based on the monitoring of the patient that is done by the doctor continuously without actually visiting the patient. Medical professionals have come up with an efficient and inexpensive method to monitor health for providing more comfortable living to the people suffering from various cardio related issues using wearable and portable devices. Due to which, visits to doctors have constantly decreased. With this the doctors or the caregivers are now able to give their complete attention to many patients at one time. Also, based on this, doctors can save many lives by imparting them a quick and valuable service. The quick service include the immediate medicinal prescription needed by the patient is available to the patient by a mobile application. This heart beat monitoring system also tells the patient with possible cautious strides to be penetrated by them. This structure proposes the patient with restorative personality and next walk to be taken after if there ought to be an event of fundamental condition.*

***Key Words***: **IoT (Internet of Things), Machine Learning, Heart rate, Sensors, K-Nearest Neighbors**

## 1. INTRODUCTION

In today's era, heart problems are increasing day-by-day at a high pace. The death rate of 55.3 million people dying each year or 151,600 people dying each day or 6316 people dying each hour due to cardiac diseases is a big issue for all over the world. Hence it is the need of hour to overcome such problems. We, therefore, proposing a change in wireless sensors technology by designing a system which included different wireless sensors to receive information of human heart rate that will be undoubtedly further transmitted on an IoT platform which is accessible by the user via internet. An accessible database is created about patient's health history which can be further monitored and analysed by the doctor if necessary. The data storage can be saved on the server permanently or can be reset via the software.

Hospitals always need better management. The database of all patients should be handy enough. But also, there should be data prevention. Also the patient data should be kept private in case. Healthcare is the most important concern of many countries in the world. Uplifting the lives of patients especially in the backward parts of the society which include the old aged, physically and mentally disabled as well as the chronically ill patients is the major factor to be improved. In existing system, the data is recorded in the form of paperwork or on general storage server. But generally that data is accessible to all the staff and doctors. Hence the proposed system provide a new way where patient and doctors able to communicate through mobile application and web application.

In hospitals there are facilities for continuous monitoring of patients. Their heart rates are always monitored. There is no option to check these parameters when they are back home. And so there is a chance that the illnesses may return again. Patient's details will be frequently scaled and sent to server. Period of sending can be set. Monitoring person learns patient specific threshold. By using an averaging method over a relatively long time, the monitoring can learn these thresholds for patients. Making use of an Android Application in doctor's smart phone, he can view the patient's medical status. When any of the parameter exceeds the threshold value they will get an alert prompting message. Using Android Application in patient's or his caretaker's smartphone the patient can view his/her health status. Early detection and diagnosis of potentially fatal extreme situations such as cardiac arrest require continuous monitoring of patients health following transfer from hospital to home. The proposed system represents a cardio-rate diagnosing system that makes use of sensors for collecting data from patients, intelligently predicts patient's health status and providing feedback to medical officers through their mobile devices having the application. The patients will part take in the health care process via their smartphone devices and thereby can access their medical information from anywhere any time.

## 2. RELATED WORK

Genaro built up an isolated wellbeing analysis in light of the indications of the patient.[1] An immense measure of gathered information is utilized to examine the sickness and danger happening to the patients. Tao Liu [2] built up a wear sensing element framework in screening the developments for patients. Framework that has aligned to an edge range under five percentage at the point of limiting blunder rates the caught values. Stefano [3] discovered a framework in screening developments on the patient health that perceives in fall consequently replies demand in help to the overseers.

Cristina [4] built up a way to deal with keep up human services information of a patient gathered in various geographic areas. The information is accessible to specialists, doctor's facilities, and research facilities and so forth. To verify therapeutic details of patients. Jerian [5] built up an identification of radio frequency innovation of canny frameworks, that recognize sterilized things and alarms medicinal staff who involved to wash their hands after contact with infected things. Information detected and sent to remote gadgets can be seen on the neighborhood framework which necessities to bolster getting information of multiple configurations, is valuable in making constant apps is to be refreshed to versatile utilization by the specialist and in addition the client. Boyi exhibited IOT related framework in offering help the crisis medicinal administrations by showing a way in which IOT information is gathered to incorporate inter-operability. Long examined fundamental necessities in point interest for product of human services he invented engineering of social insurance and IOT. Heart rate monitoring system is introduced to screen and assess performance of each patient by specialist even though in nonappearance of specialist in clinic or close. Regularity of a pattern can be calculated with the difference of the consecutive occurrences of the particular pattern, the maximum difference value is considered as regularity of a pattern [6] [7] [8] [9].

## 3. THEORY

A. Internet of Things

Speaking of IoT, internet of things is a concept of computing that details the action of general objects that are connected to the inter-network and are able to isolate themselves to other devices. The above mentioned technique is simply categorized as RFID as for the method of intercommunication, though it includes other sensory technologies or QR codes. The IoT is of great significance because anything that can represent itself digitally becomes something of great importance by itself. No more is the object related to its user alone, but is now connected to surrounding objects and database data. When many elements act with uniformity, they are said to be having "ambient intelligence."

B. Heartbeat Sensor

The sensor used here is LM358 sensor. It is used to measure the heartbeat of the patient. It gives digital output of heart beat when a finger is placed on it. It is compressed in size. The working voltage of heart beat sensor is +5V DC. It runs on the basis of light intensity variation by blood flow through skin at each beat of heart. Heart rate counter is used to retrieve heart beat per minute which normally is between 60-100bpm.

C. Communication Network

In heartbeat monitoring system, wireless network is used to forward measurement through a gateway towards android application and to the server. The main network used here is IoT. The meaning of IoT is Internet of Things, simply called as Internet of everything. Different wireless communication technologies can be used for (i) connecting the IoT device as local networks, and (ii) connecting these local networks (or individual IoT devices) to the Internet. The connectivity technologies are NFC, Bluetooth, zigbee, cellular network etc. In this paper, we use Bluetooth connectivity because of its reliable high-speed connectivity. However, they also have a low power consumption profile.

## 4. ARCHITECTURE AND DESIGN: MONITORING OF HEART BEAT

The engineering of HEART BEAT MONITORING SYSTEM consists of 3; they are gathering stage, sending stage, use stage. Heartbeat sensor is used in gathering information required from patient. Information gathered in the accumulation stage to be conveyed to specialist in order to assess values for conclusion. Gathered information is to be conveyed to specialist by various correspondence channels that rely upon position of the patient. Sent gadgets were utilized as a part of the transmission stages by Bluetooth modules.

Figure 1 shows the functional diagram of the Heartbeat monitoring system. The user monitors the heartbeat with the help of the sensor module and the heart rate is transferred to the server through the Bluetooth connection. The doctor or specialists can see the patient's recordings and can suggest medicinal prescriptions accordingly.

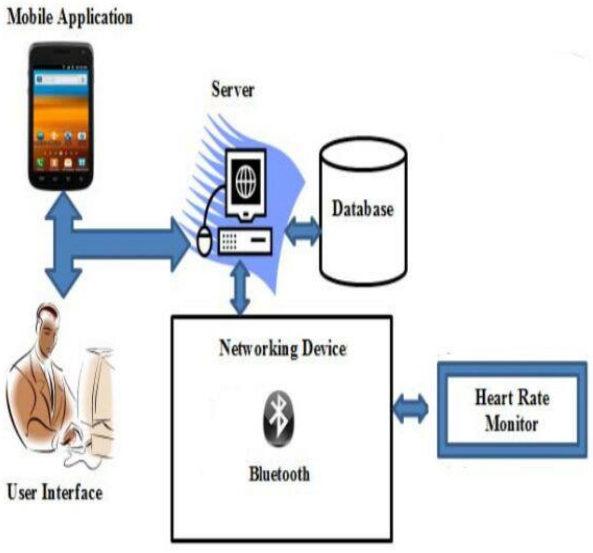


**Fig-1**: Functional Diagram

Versatile app consequently demonstrates dangers shaded to red to caution the patient when temperature reaches high, circulatory strain range increments and rate of heart is not of the typical heartbeat. Heart rate values are in the table.

**Table-1**: HEART RATE VALUES

| Status | BPM |
|---|---|
| Bradycardia | <40 |
| Normal/Rest | 60-90 |
| Workout | 90-130 |
| Tachycardia | >130 |

The gadgets intellect information from client's sensors and transfer it to a nearby framework by remote sensor gadgets. Versatile request intended to take advantage by specialists and clients.

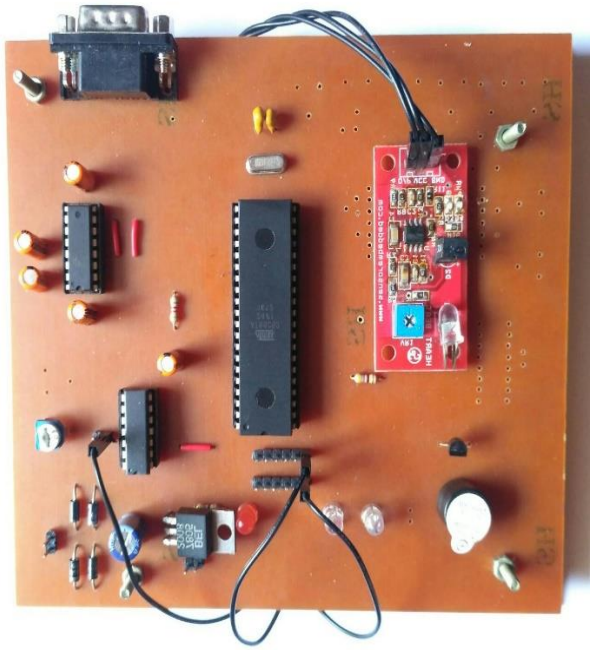

**Fig-2**: Heartbeat Measuring Module

Wellbeing position of client is refreshed in a request by regular intervals next to server refreshed data. Information gathered by the IOT gadget is trained using K-NN algorithm for finding out the medical condition of the patient. The throughput is reliable on whether k-NN is used for classification or regression:

In k-NN classification, the output is a class membership. An object is classified by a majority vote of its neighbors, with the object being assigned to the class most common among its k nearest neighbors (k is a positive integer, typically small). If k = 1, then the object is just given to the class of that particular nearest neighbor.

In k-NN regression, the output is the characteristically taken value for the object. This value is the average of the values of its k nearest neighbors. Considering regression and classification, a better method can be used to impart weights to the neighbors, so that the closest neighbors give away more to the average than the more distant ones. The k-NN algorithm lies among the easiest of all machine learning algorithms.

The algorithm is absolutely different from the k-means, which is another famous machine learning implementation. A identity of the k-NN algorithm is that it is sensitive to the local structure of the data. K-Nearest Neighbors ranks amongst the most primitive yet essential classification of algorithms in ML. This property is highly implementable in real-life scenarios since it is not parametric, it does not generate any basic assumptions about the structure of data. It attaches itself to the supervised learning category and finds immense applications in pattern recognition, data mining and intrusion detection. KNN concludes the result using a training dataset.

Predictions are made for a new instance (x) by searching through the entire training set for the K most similar instances (the neighbors) and summarizing the output variable for those K instances. When it comes to regression it is the mean output variable, in classification it might be the mode (or most common) class value. To understand which among the K instances in the training set are most identical to a new input, a distance vector is used. Taking real-valued input parameters, the most recommended distance measure is Euclidean distance. Euclidean distance is calculated as the square root of the sum of the squared differences between a new point (x) and an existing point (xi) across all input attributes j.

Euclidean Distance(x, xi) =sqrt( sum( (xj – xij)^2 ) )

Let m be the number of training data samples. Let p be an unknown point.

1. Store the training samples in an array of data points arr[]. This means each element of this array represents a tuple (x, y).

2. for i=0 to m:

3. Calculate Euclidean distance d(arr[i], p).

4. Make set S of K smallest distances obtained. All of these distances point out to an already classified data field.

5. Return the majority label among S.

When kNN is used as classifier, the result can be measured as the class with the most frequency from the K-most similar instances. Every instance in data set points for their class and the class with the most points is taken as the resultant. Class probabilities can be obtained from average frequencies of samples that belong to each class in the set of K most similar instances for a new data instance. The following figure shows the training input data set used for this project.

| | asthma | hypertens | cardiac(ill | normal | rest | workout | child | adult | avg |
|---|---|---|---|---|---|---|---|---|---|
| 2 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 75 |
| 3 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 85 |
| 4 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 91 |
| 5 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 60 |
| 6 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 90 |
| 7 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 100 |
| 8 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 110 |
| 9 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 70 |
| 10 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 100 |
| 11 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 110 |
| 12 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 120 |
| 13 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 80 |
| 14 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 110 |
| 15 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 120 |
| 16 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 130 |
| 17 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 90 |

**Fig -3**: Training Input Dataset

Based on the training data set the output of the machine learning algorithm categorize the medical condition into four.

Tachycardia

Tachycardia is a common type of heart rhythm disorder in which the heart beats faster than normal while at rest. When the heart rate immediately exceeds or abruptly increases, the heart beats with decreased efficiency and less blood reaches to the rest of the body, including the heart itself. The increased heart rate also leads to increased work and oxygen demand by the heart, which can lead to rate related ischemia [10].

Bradycardia

Bradycardia can be termed when heart beats slower than normal rate. Bradycardia typically does not cause symptoms until the rate drops below 50 BPM. Considering symptomatic conditions, results in fatigue, weakness, dizziness, sweating etc.

Healthy

A normal resting heart rate for an adult ranges from 60 to 100 beats a minute. This condition ensures a healthy heart.
Medicate

When the heart rate is slightly more than the normal rate a person needs to medicate. The patient can rest for some time or take some previously prescribed medicines to cop up with the situation by himself.

So we conclude that any patient with tachycardia and bradycardia condition needs the immediate attention of a doctor as they have arrhythmia. The android application gives the notification for consulting the doctor which has been allocated to the patient.

## 5. RESULTS AND EVALUATIONS

This framework receipts the information by the IOT gadgets for at regular intervals and refreshed into the database associated to a server. A specialist will be able to see the patients' wellbeing disorder at regular intervals. Information gathered by clients sensors and its assessment the request, demonstrated the watched information is refreshed effectively.

In the proposed system a Smart Heartbeat Monitoring System was implemented. It worked successfully. By using biomedical sensors, we saved patient's heart beat rate and transmitted it to the android application via Bluetooth.

The data is further uploaded in the server. We also developed an android application named Heart Life. In this app patient can see nearby hospitals, home remedies, use medicine reminder and doctors' can see their patients' health parameter in Heart Life application to diagnose the results sitting far away from the patients. The system detects the abnormal heart rate condition called arrhythmia and suggests the possible remedies without going to a doctor. Table II shows the average pulse rate of ten patients for two days and their observed heart beat conditions.

**Table-2**: SAMPLE PULSE RATE OF 10 PATIENTS

| Patient Id | Pulse Rate | Status |
|---|---|---|
| P1 | 75 | Healthy |
| P2 | 85 | Healthy |
| P3 | 95 | Medicate |
| P4 | 135 | Tachycardia |
| P5 | 40 | Bradycardia |
| P6 | 100 | Medicate |
| P7 | 69 | Medicate |
| P8 | 126 | Tachycardia |
| P9 | 50 | Bradycardia |
| P10 | 140 | Tachycardia |

## 6. CONCLUSION

According to the above mentioned system, it is taken that Wireless sensor technology is an upcoming and significant part of medical services. In this proposed system a mobile physiological monitoring system is presented, which is able to continuously monitor the patient's heart beat without visiting the hospital. Any abnormalities in the health conditions can be known directly and are informed to the particular person via internet. The proposed system is simple, power efficient and easy to understand. It acts as a connection between patient and doctor. The hardware for the project is implemented and the output results are verified successfully.

Futuristic scope to this can be a combined unit which acquires less space and is easier to operate in any

environmental conditions and not affecting the results specially in outdoor monitoring. Another future scope of work is miniaturization of the system to have portability by adding an embedded FPGA system. The advancement to the system can be brought about by embedding the hardware in a small chip and worn on wrist.

In place of the LM358 data acquisition device, a wireless data acquisition device can be used which makes the whole system more convenient and adaptable. It is also possible to integrate advanced communication technologies such as Wi-Fi into our system thereby making it capable to feed live processed ECG and fall signals to long distances.

## REFERENCES

[1] Gennaro Tartarisco, Giovanni Baldus, Daniele Corda,Rossella Raso, Antonino Arnao, Marcello, Andrea Gaggioli, GiovanniPioggia, "Personal Health System Architecture for stress monitoring and support to clinical decisions", Computer Communications Vol. 35.,pp.1296-1305,2012.

[2] Tao Liu, Yohio Inoue, Kyoko Shibata, "Development of a wearable sensor system for quantitative gait analysis", Measurement Vol.42, pp.978-988, 2009.

[3] Cristina Elena Turcua, Cornel Octavian Turcua, "Internet of Things as Key Enabler for Sustainable Healthcare Delivery", Procedia- Social and Behavioral Sciences Vol.73, pp. 251-256, 2013.

[4] Jieran Shi, Lize Xiong, Shengxing Li, Hua Tian, "Exploration on intelligent control of the hospital infection the intelligent reminding and admistration of hand hygiene based on the technologies of interne of things", Journal of Translational Medicine, Vol.10., No.2,pp.55, 2012.

[5] Boyi Xu, Li Da Xu, Honggming Cai, Cheng Xie, Jingyuan Hu, and Fenglin Bu, "Ubiquitous Data Accessing Method in IOTBasedInformation System for Emergency Medical Scervices", IEEE Transactions on Industrail Informatics, Vol. 10, No. 2, May 2014.

[6] G. Vijay Kumar, Dr. V. Valli Kumari" Incremental Mining for Regular Frequent Patterns in Vertical Format", International Journal of Engineering and Technology, Volume 5, Issue 2, 2013.

[7] G. Vijay Kumar, Dr. V. Valli Kumari "MaRFI: Maximal Regular Frequent Itemset Mining using a pair of Transaction Ids",International Journal OF Computer Science and Engineering Technology, volume 4 No. 7,2013.

[8] G. Vijay Kumar, Dr. V. Valli Kumari," Parallel and Distributed Frequent-Regular Pattern Mining using Vertical Format in Large Databases", IEEE Xplore, ARTCom 2012.

[9] G. Vijay Kumar, Dr. V. Valli Kumari, " Sliding Window Technique to Mine Regular Frequent Patterns in Data Streams using Vertical Format",IEEE International Conference on Computational Intelligence and Computing Research 2012. International Conference on Trends in Electronics and Informatics ICEI 2017

[10] Harrison's Principles of Internal Medicine, 17th Edition

## BIOGRAPHIES

Prof. Neethu Subash
Computer Science and Engineering Assistant Professor at Mar Athanasius College of Engineering, Kothamangalam, Kerala, India

Aswin M
Computer Science and Engineering Student at Mar Athanasius College of Engineering, Kothamangalam, Kerala, India

Githu Jeeva Savy
Computer Science and Engineering Student at Mar Athanasius College of Engineering, Kothamangalam, Kerala, India

Moncy Puthenpurackal Mody
Computer Science and Engineering Student at Mar Athanasius College of Engineering, Kothamangalam, Kerala, India