

# IoT on Heart Attack Detection and Heart Rate Monitoring

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**Abstract**—Life is valuable. Many people are losing their life due to heart attack. Due to the late detection of the attack we are unable to save the life of a human. Usually heart attack detection is done traditionally using specialized hardware devices. With the help of increased technology we should be able to capture and monitor the changes in our body. In this paper we propose a system which will detect heart attack with help of different scenarios i.e.; monitoring heart rate and smart blood pressure system based on IOT (Internet of things). This proposed system not only detects the heart attack but also other heart diseases. To get rid of these heart attacks or to reduce this heart disease we are developing this system to reduce the death rate.

**KEYWORDS:** DETECT, MONITORS, IOT, SMART BANDS

## I. INTRODUCTION

Internet means network of networks which is connected worldwide based on a standard communication protocol (TCP/IP). IOT is a trending technology which is having an ever-growing network of physical objects that feature an IP address for internet connectivity, and the communication that occurs between these objects and other Internet-enabled devices and systems. Sensors, Actuators, RFID devices are outfitted with objects which are interconnected worldwide. These devices are specifically addressed by utilizing standard communication protocols in different environment including objects of entire different technologies and many application fields. The internet of things is driven by the combination of 1) sensors 2) connectivity 3) people & process.

### A. Enabling technologies for IOT

The Internet of Things was at first enlivened by individuals from the RFID people group, who alluded to the likelihood of finding data around a labelled item by scanning a IP address or database address that corresponds to a specific RFID or Near Field Communication technologies. In the research paper "Research and application on the smart home based on component technologies and Internet of Things", the included key advances of IoT are RFID, the sensor technology, nano technology and intelligent embedded system. Among them, RFID is the establishment and systems administration centre of the development of Internet of Things. The Internet of Things (IoT) empowered clients to bring physical items into the circle of digital world. This was made conceivable by various labelling advancements like NFC, RFID and 2D scanner tag which permitted physical items to be recognized and alluded over the internet. They play a role in wireless technologies and also wired technologies. Some are Bluetooth low energy, Wi-Fi Direct, Ethernet, Zigbee, Low energy wireless IP networks etc.

### B. Medical and Healthcare System

IOT devices also used in medicine for remote health monitoring and emergency notification systems. The health monitoring system can range the blood pressure, heart rate monitor devices helps to caution the person and take required steps. Even this health monitoring system can also be monitored by sensors can also be equipped within living spaces to monitor the health and this is generally useful for senior citizens. The system we proposed combination of remote health monitor and emergency monitoring system using some wearable device like smart bands. An activity tracker is a device or application for monitoring and tracking fitness-related metrics such as distance walked or run, calorie consumption, and in some cases heartbeat and quality of sleep. We are developing a system which will help to decrease the death rate due to heart attack by early detection of heart attack. In our system we will be using smart bands/ health bands which are easily available in market. These smart bands will continuously monitor heart rate of a user. When the heart rate of a user goes below a danger value, the near smart phone will get notified and the application installed in the smart phone will notify to concerned people of the user and will also notify to ambulance service. The smart band and the application will be connected by Bluetooth.

## II. EXISTING SYSTEM

Microsoft Band is a smart band with smart watch and activity tracker/fitness tracker features, created and developed by Microsoft. It was announced on October 29, 2014. The Microsoft Band incorporates fitness tracking and health-oriented capabilities and integrates with Windows Phone, iOS, and Android smart phones through a Bluetooth connection.

### A. MI BAND 1S

A new version is coming! Mi Band 1S, a heart rate wristband - Everyone is worth having. During aerobic exercise, have a good heart rate, it is better to loss weight and improve cardiorespiratory capacity. Mi Band 1S equipped with a optical heart rate sensor, can real-time detect heart rate, let you adjust the motion state scientifically and consume fat efficiently. Mi Band 1S manages your motion every moment and take good care of you. Table 1 elaborates the features of MI BAND 1S

TABLE I  
FEATURES OF MI BAND 1S

Feature	Description
Heart rate monitor	1S with optical heart rate sensor, shows you heart rate with PPG, you can see the results more intuitively.
10 days standby time	Top-level Bluetooth chip and military gravity sensor ensure 10 days ultra-long standby time for a full charging.
Call reminder	Mi Band 1S will tell you when a call comes, you never need to worry about missing any important calls.
Sports tracking	Track your sports, record steps, distance and calories, help you achieve your sports target.
Sleep monitoring	Let you know your deep sleep and shallow sleep, also APP will give you periodical evaluation, help you develop good living habits.
Silent alarm	Wake you up every morning, will not be late for work; Remind you with vibration, never worry about missing anything.
Free password to unlock the phone	Forget complex unlock password and gesture, simply raise your hand to close to phones, immediate and safe unlocking.

Talking about the disadvantages of Mi band1S, it is rather said that it has more disadvantages, and the disadvantages can be overlooked considering the price and features you get. But since here are few disadvantages.

- The feature showing the duration of sleep is ambiguous, once a person slept in afternoon it didn't record the time slept in afternoon, so it is clear that the device as an algorithm of tracking your sleep pattern on two criterions.
  - a. Motion of your body
  - b. Illumination of your environment.

Hence it can't be used to track sleep pattern in afternoon or you just lie down for a nap with bedroom lights switched on making it a ambiguous device.

- The biggest drawback of Mi band is that it lacks a display, you always have to have a mobile phone in order to use the Mi band, and the band just has 3 led lights which indicate the notifications depending upon the sequence of glow of lighting. Moreover the lead lights aren't clearly visible in illuminated environment.

All these disadvantages were overcome in MI BAND2.

### B. MI BAND 2

Mi Band 2 is a smart watch bracelet for you, especially for sports lovers! Do you know how many steps you take, how many calories you consume, and how far you run? Don't worry, when you wear the bracelet to do exercise, such as running, climbing, all these data can be synchronized and analyzed on your mobile phone which helps you plan your exercise time and amount more reasonably. It comes with TPU adjustable wristband, giving you a skin-friendly, breathable feeling. When you sleep, it will monitor your sleep. It can also wake you up by vibrating gently. Mi Band 2 record every moment staying with you. Just to live a healthy life with it!

Wearable sensors have been widely used in medical sciences, sports and security. Wearable sensors can detect abnormal and unforeseen situations, and monitor physiological parameters and symptoms through these trackers. This technology has transformed healthcare by allowing continuous monitoring of patients without hospitalization. Medical monitoring of patients' body temperature, heart rate, brain activity, muscle motion and other critical data can be delivered through these trackers. Moreover, in sports training there is an increasing demand for wearable sensors. For example, measurement of sweat rate was possible only in laboratory based systems a few years ago, but is a now possible using wearable sensor. Table 2 elaborates the features of MI BAND 1S

TABLE 2  
FEATURES OF MI BAND 2

Feature	Description
<b>Bluetooth Synchronization</b>	With Bluetooth 4.0, this smart watch is available for smartphones with Bluetooth functions.
<b>OLED Touch Screen</b>	Just touch the circular button gently, the OLED screen will display current time, steps, heart rate, distances, calories, etc.
<b>Heart Rate Monitor</b>	It can dynamic-static monitor your heart rate, provide data for you at any time.
<b>Incoming Calls / APP Message Alert</b>	When someone calls or sends any messages in your phone, the watch will remind you via vibrating, so you will never miss them!
<b>Sleeping Monitoring</b>	Accurately monitor total effective sleeping time and motions time every night, also APP will give you periodical evaluation, help you develop good living habits.
<b>Sport Monitoring</b>	This smart watch can record steps, calories and distance. Let you know your sports data, adjust your exercise program and get a healthier life!
<b>Intelligent Alarm Function</b>	Wake you up every morning, will not be late for work; idle alert to remind you with vibration, stretch your legs after working for a

	long time.
<b>No Passcodes Required</b>	Every Mi Band 2 have an exclusive ID, when you're smart phone closes with the band, your phone will be unlocked, just identify yourself with Mi Band 2.
<b>IP67 Waterproof</b>	The IP67 waterproof allows the bracelet to be held in the water for a maximum of 30 minutes at a depth of 1 meter. ( Don't wear the bracelet when diving )
<b>Full Compatibility</b>	Support Android 4.4 or above and iOS 7.0 or above with Bluetooth 4.0.

The Band's battery can run for two days on a full charge, and the device partially relies on its companion app Microsoft Health, which is available for operating systems beginning with Windows Phone 8.1, Android 4.3+, and iOS 7.1+, if Bluetooth is enabled.

### III. PROPOSED SYSTEM

The system which we proposed have the quality of detecting heart attacks with the help of monitoring heart rate and blood pressure based on internet of things. Every user will be wearing a device. This system is something like wearable device which can be placed on once wrist so which contains a sensor helps to monitor the heart rate and even blood pressure and using these scenarios we can detect heart attack occurrence. The sensor is a built in device. When the device is placed on wrist it records the data i.e.; pulse rate so that it monitors the heart beat. The device also has the sensor which records the blood pressure using the pulse rate, peak systolic pressure and baseline systolic pressure. At first we have to record the default values(the values denotes the critical situation) for pulse rate, peak systolic pressure, baseline systolic pressure in the sensor so that the application records the user's activity and checks the collected data of the user with the default values whether it is near to it or not. When the recorded heart beat i.e.; pulse wave and pressure are in the critical state, then an alert message is sent to that person's mobile or the mobiles present in surrounding of that particular person notifying them about the person who is in critical condition and first aid to be taken to the person.

The following is the architecture of heart attack detection and heart monitoring using IOT with the scenarios like calculating blood pressure and pulse rate.

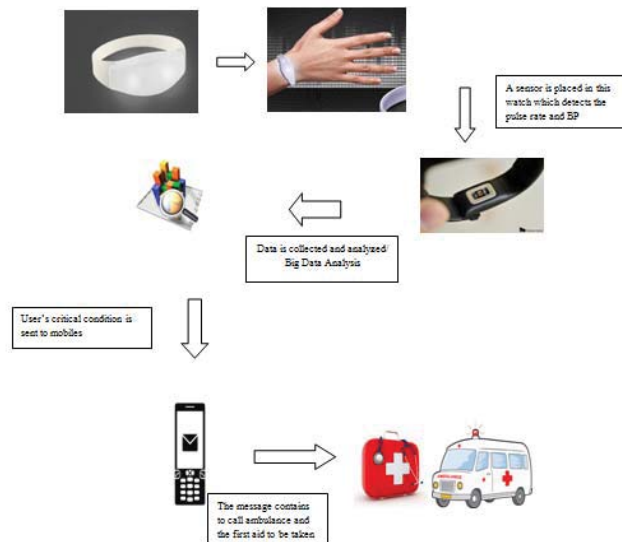


Fig. 1. Architecture of Proposed System

#### C. Wearable devices

Every user will be wearing a device. As today smart bands are common in the market and are easily available. The band will be monitoring the heartbeat of the user and will be processing it. If the heartbeat of the user is in critical condition then the band notify to the android Smartphone. The heart rate monitoring sensor is built in the

device. The device uses PPG method to detect the heartbeat. Even this contains a blood pressure gauge which helps to find the heart condition, to find the blood pressure the sensor contains. The data processing centre can receive the data (i.e., pulse wave) transmitted from user's blood pressure monitor in real-time, and at the same time, some normal blood pressure monitors at the data processing centre will measure this same user's blood pressure together. Then, the data processing centre will analyze the data that measured by user's blood pressure monitor and the data measured by the data processing centre.

#### *D. Android Smartphone*

The smart band will be connected to mobile phone by Bluetooth. This band sends the data to the phones using WLAN or Bluetooth. In this android phone the user have to install the app so that it collects the information from the smart band using the sensor placed in it. This application will start monitoring the user's activities and checks the user's blood pressure and heart rate. When the heart beat reaches the critical level i.e.; default values which are already stored in the device, it will alert the contacts. The device even sends a message notifying to call the ambulance. The smart band checks the data accurately and the gives and alert message when the user reaches the critical level.

#### *E. Notifying the emergency contact*

The user needs to enter the contacts in the application so that it even sends the message to the contacts present in it at the time of emergency. At the time of emergency it sends an SMS to surrounding mobiles and contacts in that application, notifying that to call an ambulance and if in critical position to call a doctor, even it notifies the first aid to be taken before the ambulance arrival to the user.

#### *F. Big Data Analytics on Medical Data*

Data is analyzed by using big data analytics, it is nothing but examine large data sets to uncover the hidden patterns, unknown correlations, market trends, customer preferences and other useful business information. Big Data is useful in health industry. The healthcare industry historically has generated large amounts of data, driven by record keeping, compliance & regulatory requirements, and patient care. While most data is stored in hard copy form, the current trend is toward rapid digitization of these large amounts of data. Driven by mandatory requirements and the potential to improve the quality of healthcare delivery meanwhile reducing the costs, these massive quantities of data (known as 'big data') hold the promise of supporting a wide range of medical and healthcare functions, including among others clinical decision support, disease surveillance, and population health management.

The theoretical system for a major Big Data Analytics in human healthcare is like that of a customary health informatics or examination venture. The key contrast lies in how handling is executed. In a normal health analytics, the examination can be performed with a business insight apparatus introduced on a stand-alone framework, for example, a desktop or portable workstation. Since huge information is by definition vast, handling is separated and executed over different hubs. The idea of conveyed preparing has existed for quite a long time. What is generally new is its utilization in breaking down extensive information sets as social insurance suppliers begin to take advantage of their substantial information storehouses to pick up knowledge for improving educated wellbeing related choices. Moreover, open source stages, for example, Hadoop/MapReduce, accessible on the cloud, has empowered the use of huge information examination in human services

Enormous information in human services can originate from inward (e.g., electronic health records, clinical choice emotionally supportive networks, CPOE, and so on.) and outside sources (government sources, research facilities, drug stores, insurance agencies and HMOs, and so on.), frequently in various configurations (level records, .csv, social tables, ASCII/content, and so forth.) and dwelling at different areas (geographic and additionally in various social insurance suppliers' locales) in various legacy and different applications (exchange preparing applications, databases, and so on.). Sources and information sorts include:

1. **Web and online networking information:** Clickstream and association information from Facebook, Twitter, LinkedIn, web journals, and so forth. It can likewise incorporate wellbeing arrangement sites, cell phone applications, and so forth [6].

2. **Machine to machine information:** readings from remote sensors, meters, and other essential sign gadgets.

3. **Huge exchange information:** social insurance claims and other charging records progressively accessible in semi-organized also, unstructured organizations.

4. **Biometric information:** fingerprints, hereditary qualities, penmanship, retinal outputs, x-beam and other therapeutic pictures, blood weight, heartbeat and heartbeat oximetry readings, and other comparative sorts of information.

5. **Human-produced information:** unstructured and semi-organized information, for example, EMRs, doctors notes, email, and paper reports

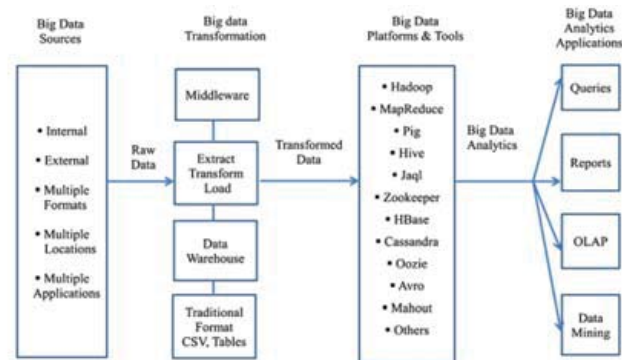


Fig. 2. An applied conceptual architecture of big data analytics

With the end goal of enormous information examination, this information needs to be pooled. In the second part the information is in a "crude" state and should be prepared or changed, at which point a few alternatives are accessible. A service oriented building approach joined with web administrations (middleware) is one probability [7]. The information sits tight crude and administrations are utilized to call, recover and prepare the information. Another methodology is information warehousing wherein information from different sources is amassed and made prepared for preparing, in spite of the fact that the information is not accessible in realtime. By means of the progressions of concentrate, change, and load (ETL), information from differing sources is purged and prepared. Depending on whether the information is organized or unstructured, a few information configurations can be contribution to the enormous information investigation stage.

In this next segment in the reasonable structure, a few choices are made in regards to the information info approach, disseminated outline, instrument choice and examination models. At long last, on the far right, the four ordinary applications of enormous information examination in medicinal services are appeared. These incorporate questions, reports, OLAP, and information mining. Perception is an overall subject over the four applications. Drawing from such fields as insights, PC science, connected arithmetic and financial matters, a wide assortment of systems and innovations has been created furthermore, adjusted to total, control, break down, furthermore, picture enormous information in human services.

The most noteworthy stage for huge information investigation is the open-source dispersed information handling stage Hadoop (Apache stage), at first produced for such routine capacities as amassing web seek files. It has a place with the class "NoSQL" advancements—others incorporate CouchDB and MongoDB—that developed to total information in novel ways. Hadoop can possibly prepare to a great degree a lot of information essentially by designating apportioned information sets to various servers (hubs), each of which settles diverse parts of the bigger issue and after that coordinates them for the last result [8-11]. Hadoop can serve the twin parts of information coordinator and investigation device. It offers a lot of potential in empowering endeavours to outfit the information that has been, until presently, hard to oversee and investigate. In particular, Hadoop makes it conceivable to prepare to a great degree substantial volumes of information with different structures or no structure by any stretch of the imagination. However Hadoop can test to introduce, design and oversee, what's more, people with Hadoop aptitudes are not effectively found. Besides, therefore, it shows up associations are not exactly prepared to grasp Hadoop totally. The encompassing biological community of extra stages and instruments bolsters the Hadoop disseminated stage [10, 11]. These are compressed as below.

- 1) *Hadoop Distributed File System:* HDFS enables the underlying storage of the Hadoop cluster. It divides the data into smaller parts and distributed it across the various servers. When HDFS takes in data, it breaks the information down into separate pieces and distributes them to different nodes in a cluster, allowing for



parallel processing. The file system also copies each piece of data multiple times and distributes the copies to individual nodes, placing at least one copy on a different server rack than the others. As a result, the data on nodes that crash can be found elsewhere within a cluster, which allows processing to continue while the failure is resolved.

- 2) *MapReduce*: MapReduce provides the interface for the distribution of sub-tasks and the gathering of outputs. When tasks are executed, MapReduce tracks the processing of each server/node. A MapReduce program is composed of a Map() procedure (method) that performs filtering and sorting (such as sorting students by first name into queues, one queue for each name) and a Reduce() method that performs a summary operation (such as counting the number of students in each queue, yielding name frequencies).
- 3) *Jaql*: Jaql is a functional, declarative query language designed to process large data sets. To facilitate parallel processing, Jaql converts “‘high-level’ queries into ‘low-level’ queries” consisting of MapReduce tasks.
- 4) *Cassandra*: Cassandra is also a distributed database system. It is designated as a top-level project modelled to handle big data distributed across many utility servers. It also provides reliable service with no particular point of failure and it is a NoSQL system.
- 5) *Lucene*: The Lucene project is used widely for text analytics/searches and has been incorporated into several open source projects. Its scope includes full text indexing and library search for use within a Java application.
- 6) *Hbase*: HBase is a column-oriented database management system that sits on top of HDFS. It uses a non-SQL approach.
- 7) *Mahout*: Mahout is yet another Apache project whose goal is to generate free applications of distributed and scalable machine learning algorithms that support big data analytics on the Hadoop platform.

Various merchants—including AWS, Cloudera, Hortonworks, and MapR Technologies—disperse open source Hadoop stages [29]. Numerous exclusive choices are likewise accessible, for example, IBM's Big Insights. Further, large portions of these stages are cloud renditions, making them generally accessible. Cassandra, HBase, and MongoDB, depicted above, are utilized broadly for the database segment. While the accessible structures and devices are for the most part open source and wrapped around Hadoop and related stages, there are various exchange offs that designers what's more, clients of huge information investigation in human services must consider. While the advancement expenses might be lower since these apparatuses are open source and complimentary, the drawbacks are the absence of specialized backing and insignificant security. In the medicinal services industry, these are, obviously, critical downsides, and thusly the exchange offs must be tended to. Furthermore, these stages/instruments require an extraordinary arrangement of programming, abilities the common end-client in social insurance may not have. Moreover, considering the just late rise of enormous information investigation in medicinal services, administration issues including proprietorship, protection, security, also, benchmarks have yet to be tended to. In the following area we offer a connected enormous information examination in medicinal services strategy to create and execute a major information venture for medicinal services suppliers.

At minimum, a big data analytics platform in healthcare must support the key functions necessary for processing the data. The criteria for platform evaluation may include availability, continuity, ease of use, scalability, ability to manipulate at different levels of granularity, privacy and security enablement, and quality assurance. Big data analytics in healthcare needs to be packaged so it is menu driven, user-friendly and transparent. Real-time big data analytics is a key requirement in healthcare. The lag between data collection and processing has to be addressed. The dynamic availability of numerous analytics algorithms, models and methods in a pull-down type of menu is also necessary for large-scale adoption.

#### IV.CONCLUSION

Generally in this approach we can detect or track the heart attacks or heart diseases and save the lives of many people using this IOT (internet of things) on heart attack detection and heart rate monitoring. This proposed system helps old age people who are frequently cause heart attacks or heart diseases by tracking their heart anomalies by notifying with an alert message to mobile phones of the user or the surrounding person's mobile using this device. Not only heart rate but also blood pressure of the user using the pulse rate. We analyze the data set collected from the pulse rate is analyzed by using big data analytics which creates user friendly and transparent environment by using different tools and platforms. By using big data analytics it provides potential and transforms the way to healthcare provides sophisticated technologies. In the future we'll see the rapid, widespread implementation and use of big data

analytics across the healthcare organization and the healthcare industry. This proposed system provides great flexibility and serves as doctor's caution for the patient.

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