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Smart Real-Time Health Monitoring Band Using Machine Learning and IoT

Yogesh V
Department of computer science and Engineering
Siddaganga Institute of Technology
Tumakuru, India
vyogeee@gmail.com

A. H Shanthakumara
Department of Computer Science and Engineering
Siddaganga Institute of Technology
Tumakuru, India
ahskondajji@gmail.com

***Abstract*—Nowadays significant progress has been made in a health monitoring system. Health monitoring watches reduce people's effort by monitoring day-to-day activity related to health. The devices which are embedded with different technologies like IOT and ML will give the endure solution for the reliable, objective and remote monitoring and support through ambient assisted living. In this research work, ML computations are used to screen the clinical issue of individuals.In Beginning getting ML computations is performed using the dataset. Testing takes out is passed on by gathering beat, circulatory strain, and temperature of the individual using IoT.**

Health trackers and body sensor devices are making exceptional impact on the idea of living and clinical benefits system. The central task of smart watches is to keep monitoring patient standard activities by giving central information concerning the activity over the entire day. This information can be obtained by using a smart band or a mobile phone application. The central objective of this watch is to give the significant information as for the electronic sensors used in these smart band and moreover their working to choose step count, beat, nature of rest, calories burned-through, etc.

"Internet-of-things" and "Machine Learning" are playing a major role in everyone's life and even in health care applications also. Especially in smart wearable devices such as smartwatches like bit fit, Rolex, and others. By using these smart devices one can easily monitor health and chance of risk. These devices are embedded with different sensors based on the application. In our application, we are using SPO2, heart rate, and body temperature attributes. These sensors' data are captured and sent to the cloud and analyzed based on machine learning techniques. The testing stage checks for any abnormalities in the clinical issue from the sensor data accumulated through the IoT framework. Genuine assessment is performed from data amassed into the cloud from IoT devices to assess the exactness in assumption rate.

***Index Terms*—Cloud, Sensors, Machine Learning, Embedded Systems, Artificial Intelligence.**

I. Introduction

Nowadays usage of smart devices is high by the old age people as well teenagers like smart Television, smartwatches, and many other electronic appliances. These devices are enabled with IoT and reach a new graph of advancements.smart device usage are embedded with different sensors and outputs and which provide dual way communication with nearby compatible device and network such as Bluetooth, Wi-Fi, etc.

The technology is continuously developing [1]. This is causing a change in lifestyle and regularly, clinical benefits needed, towards torments related on a very basic level (anyway not just) with older people. The most obvious of those is dementia, in its underlying and progressed structures, from delicate mental weakness (MCI) to Various affliction, a neuro degenerative issue with a couple of scholarly and pragmatic requirements.

In this era, technologies are giving more comfort promising solutions to monitor human activities and decreasing the burden of the human, and makes effortless for decision making. "IoT" and "ML" technologies are new concepts in this health-related area with the use of a wearable device that includes different predicting algorithms [7].

One of the critical usages of these adroit devices is in the field of clinical consideration to the extent dynamic work, hear beat, rest data, etc [13]. can be noticed reliably with the help of wearable contraptions like smartwatches, sharp gatherings. These contraptions when worn assemble close - continuous data, engaging predictable checking of real work. These contraptions are available just as they are straightforward, this has become an extra advantage for the extended usage of these gadgets [12]. Likewise, these contraptions can enable correspondence between patients, family members, and in case of emergencies, prepared messages can be delivered to family members and clinical consideration providers.

II. WEARABLE TECHNOLOGY

Devices that can be wear is also called smart devices, which allow monitoring a particular patient's health. It contains various sensors which monitor the different parameters of health [2].

SPO2 is used in keen searches for oxygen checking of the body, which can perform assessments parallelly with the other two sensors. The temperature sensor is used to screen inside heat level and the heartbeat sensor is used to screen thump rate. These sensors are used to perform the lead of an individual. Joining all sensor data helps in distinguishing the position. Using Optical Sensors, this research work can screen heartbeat, thump rate, etc [3]. Heart rate monitors have become a common feature in a variety of wearable gadgets, including Smart Watches and Chest Straps. These wearable heart rate

Fig. 1. Health tracker with Bluetooth Device connectivity

(HR) monitors have provided the user with some insight into heart rate fluctuations during exercises [6].most used optical sensor is Mio Global Heart Rate Monitor. Temperature sensors will balance interior warmth level with enveloping temperature with choosing the exertion levels [4].

At the point when the data is accumulated (distinguished by using a particular sensor), by then the accompanying stage is data consideration, data depiction, and examination. Wear OS, Android, Asteroid OS, Sailfish OS, watch OS, Tizen, Ubuntu Touch are a bit of the functioning structures for wise watches [5]. Android OS is routinely used in the proposed sharp watches.

III. ARCHITECTURE

Below mentioned are the features and the components which are present in the Architecture of ML and IoT sensor system which is represented in fig 2. The features of the smartwatch are a Mobile dashboard for patients and cloud permission to clinical benefits providers, wrist band removal alert, and Bluetooth low energy connectivity [8].

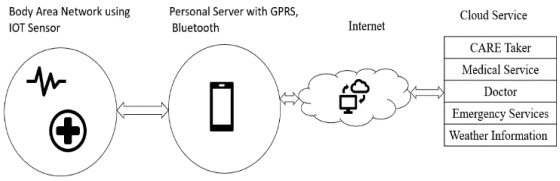

Fig. 2. Architecture of ML & IoT sensor system using a wearable device

A. Body region network utilizing IoT sensor framework

The sensors like temperature, Heart Rate, and SPO2 are monitored can be a record by the device and these data have been sent to the cloud database, where we are using our database [9]. The health record is prepared by the wearable device.

B. Individual specialist with GPRS, blue tooth, or WLAN:

The data from the cloud system is stored in the database in the device where the user can get the complete information based on a particular id of the device. This device can send or receive data from the IoT sensor system [10].

C. Internet

The data which is taken care by cloud in the close by contraption can be delivered to a smart watches by taking the cloud organization. There the data can be given to the cloud organizations, for instance, setting off exercises, prosperity record examination, environment information, emergency organizations, expert reviews, clinical specialists.

D. IOT architecture for disease detection

This framework gives a stage for checking and supervising patients by the use of sensor organizations. The plan comprises both equipment and programming areas. The equipment area incorporates a Heart rate sensor, Temperature sensor, and spo2 [11]. The phases of the cycle are as follows: assortment of sensor esteems, stockpiling of information in the cloud, and the investigation of the information put away in the cloud to check for anomalies in the wellbeing condition [14].

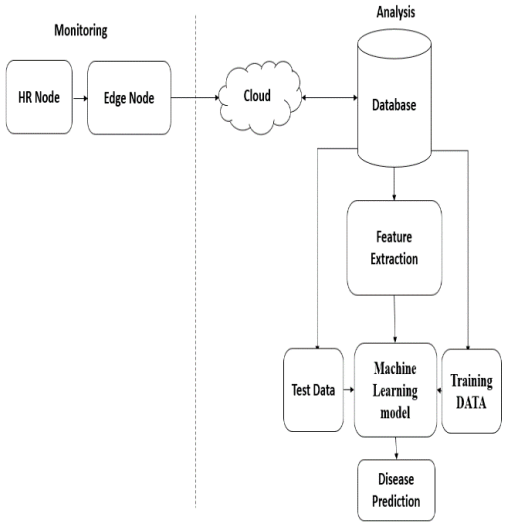

Fig. 3. IOT Architecture

E. Linear Regression, Naive Bias, SVM, KNN

KNN: The data assembled from the glove is then delivered off the own cloud from where a dataset is outlined and a while later ML is used on that particular dataset. The dataset is ready for the request for hypoglycemia and the customary state. Since hypoglycemia shows signs of extended heartbeat, low temperature, and low oxygen level, these appearances are used to orchestrate the circumstance with the patient. The testing data is then taken from the wearable device and a short time later dealt with into the pre-arranged model. a hypoglycemic and normal person. Fig 3 shows the working of KNN computation.

Linear Regression : Linear regression is one of the algorithms that belong to the supervised learning model. It is used to perform a task on continuous values. Based on

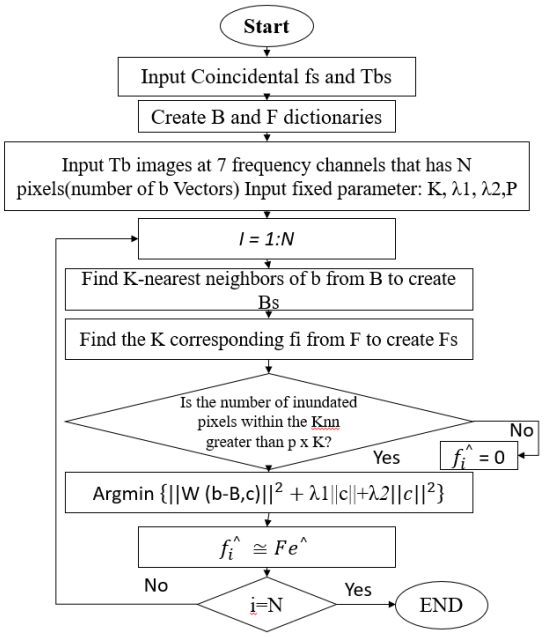

Fig. 4. Proposed System

individual values the operation will be performed in this algorithm, operation performs to predict the value on the dependent variable value on a given independent variable. Which has been shown in the below expressions. Simple linear regression is the simplest straightforward instance of a single scalar predictor variable x and a single scalar responder variable y. This regression's equation is expressed by

$$y = a + bx \tag{1}$$

$$a = \frac{\lfloor (\sum y) \sum x^2 - (\sum x)(\sum xy) \rfloor}{\lfloor (n \sum x^2) - \sum x^2 \rfloor} \tag{2}$$

$$b = \frac{\lfloor n(\sum xy) - (\sum x)(\sum y) \rfloor}{\lfloor (n \sum x^2) - \sum x^2 \rfloor} \tag{3}$$

Support Vector Machine: This algorithm also belongs to one of the supervised learning techniques of machine learning, the advantage of this algorithm is it can be used for both classification and regression. In most of the classification problems, it will be used because of its accuracy. The main advantage of using this algorithm is high dimensional spaces and the number of samples [15].

Naive Bayes: This algorithm also belongs to intelligent class learning in machine knowing technique, this is especially used to solve classification problem, it easy and simplest algorithm works very quickly and faster with a huge data set to build model and prediction can happen fast.

$$P\left(\frac{x}{y}\right) = \frac{p\left(\frac{y}{x}\right) p(x)}{p\left(\frac{y}{x}\right) p(x) + p\left(\frac{y}{z}\right) p(z)} \tag{4}$$

Where x is class variable and y is dependent future. Here we are trying to find the probability of event x considering the event y is true

Decision Tree Classifier: This algorithm is used to split the data in the training set, which should be the input, and what should be output is the one working of the decision tree, this also belongs to the supervised algorithm. In which the data set will divide accordingly with certain parameters. this can be explained by the tree and leaves parameter. Decision trees are fast processing and based on the data set and problem statement decisions will be taken at in faster rate.

Machine learning is the investigation of calculations that can gain from and make forecasts on the information. It is additionally called as identified with forecast making on certain information. There are many machine learning algorithms in which we are using KNN, naive Bayes, decision tree classifier, SVM, and random forest. It is a supervised ML algorithm, which is used for both classification and regression. This algorithm is mainly used in classification problems. Each data item is placed in n-dimensional space.

IV. LIMITATIONS

Smartwatches have obtained a special status within a very short period. The usage of these devices has been drastically increased over the past few years due to their easy availability, economic aspect, and advantages over traditional mechanical watches. Despite all the advantages, the following are the few drawbacks that are responsible for less adaptability of these devices

The smart hand wristed devices will give the update in a bit of time. As we all know nowadays everyone is using these kinds of device and it had been increased drastically over the past few years due to easy accessibility and advantage over the traditional one. Even though there is a lot of advantage, there are some disadvantage/drawbacks: 1. Restricted battery power 2. Watch arrangement: Proper situating of the gadget is needed to guarantee that the information gathered is precise. The sensors installed in keen watches will work effectively just when the watch is in touch with the skin. Inappropriate arrangements of the gadget may prompt inaccurate outcomes. 3. Security and protection - Data security, exactness are significant difficulties that must be tended to appropriately while planning a savvy.

V. RESULTS AND DISCUSSION

The Fig 4 shows the Data which is stored in the IOT cloud in graphical representation.

The canny of the endeavor shows exact results when the vitals of the patient are moved to the cloud and in case of an emergency wherein, the patient goes to an uncommon state which needs brief help to the patient. The single way the hardware breakdowns is when there is a short out of the sensors on the wearable contraption. Fig 5 shows the eventual outcome of the ML model which describes the current status of the patient using the pre-arranged dataset and the data

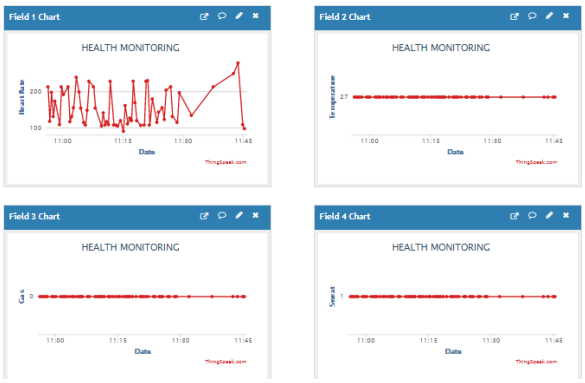

Fig. 5. Patient Data Stored in cloud

given in the dashboard using the KNN estimation, Support Vector Machine, Naïve Bayes, Linear Regression, Decision Tree classifier. The exhibition examination for example the

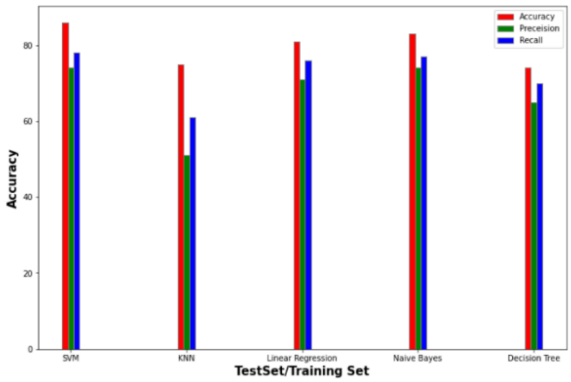

Fig. 6. Analysis of Classification

disarray grid of the machine. On computing this, we get KNN-75%, SVM-86%, NB-83%, DT-74%, and LN-81%

VI. CONCLUSION AND FUTURE WORK

The Internet of things (IoT) gathers every crucial information, shares that information with other related contraptions.IoT based clinical consideration structure offers support in quick manner which would help with saving many lives. This paper is revolved around the sensors in the wellbeing band and clinical benefits, structure model with the usage of ML and IoT.

In the future, we can add some other sensors to read different parameters along with the present and also some new machine learning algorithms which give better accuracy and result. This will enhance the analysis of the patient's health condition. To utilize more modest and lightweight sensors to oblige a greater number of sensors on the wearable gadget to measure a greater number of boundaries consequently making the grouping of infections more exact and accurate. Deep learning approaches will be the focus of this research as a future enhancement in order to improve the process' efficiency and accuracy. The creation of an algorithm is mostly focused on increasing the process's speed and storing of data.

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