Smart Body Monitoring system using IoT and Machine Learning

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ABSTRACT:In the modern health care environment, the usage of IoT technologies brings convenience of physicians and patients, since they are applied to various medical areas. The body sensor network (BSN) technology is one of the core technologies of IoT developments in healthcare system, where a patient can be monitored using a collection of tiny-powered and lightweight wireless sensor nodes. However, the development of this new technology in healthcare applications without considering security makes patient privacy vulnerable. In this paper, at first, we highlight the major security requirements in BSN-based modern healthcare system. Subsequently, we propose a secure IoT-based healthcare system using BSN, called BSN-Care, which can efficiently accomplish those requirements. The body sensor network (BSN) technology is one of the most imperative technologies used in IoT-based modern healthcare system. It is basically a collection of low-power and lightweight wireless sensor nodes that are used to monitor the human body functions and surrounding environment. Since BSN nodes are used to collect sensitive (life-critical) information and may operate in hostile environments, accordingly, they require strict security mechanisms to prevent malicious interaction with the system.

KEYWORDS: Body Sensor Network (BSN), IOT, Machine Learning, Fuzzy Logic & Random Forest Algorithms.

I.INTRODUCTION

Development of telemedicine technology increase rapidly becomes more sophisticated and widely used to support applications in the health sector. One of the technologies which are support telemedicine is wireless sensor network (WSN) for a vital signal monitoring system. Furthermore, WSN is connected to the internet that can be accessed widely; the technology is commonly known as the Internet of Things (IOT). IOT is a dynamic network that can use the intelligent interface that can be effortlessly integrated into the global information network. One of a vital signal in health is the ECG signal which can provide heart health information. Observation of the ECG signal is sometimes performed continuously and not limited to space and time, which means not only in health care centres. During recent years, rapid evolvement of healthcare services for providing wireless communication media between doctor and patient through wearable technologies which refers in "telemedicine". The artefact is to provide real-time monitoring of chronic illness such as heart failure, asthma, hypotension, hypertension etc. located far away from the medical facilities like rural area or a person out of health services for a change. In all such circumstances, heart disease becomes leading cause of death due to change in life style applicable for all age groups. Literature narrates approximately 2.8 billion people die because of heart problem due to overweight or obese which ultimately affects cholesterol level, ups and down of blood pressure and more importantly influence of stress hormones on ultimate heart conditions. In much of wearable technologies common parameters of heart functioning like BP, blood glucose level, blood oxygen saturation, ECG etc. were analysed. In accordance with all these, need of hormonal imbalance due to stress factor i.e. mood of the person (mental health status) and impact of good / bad cholesterol is also deliberated in detail.

II.LITERATURE SURVEY

According to de Carvalho Junior et.al. [1] authors had presented the feasibility study and the progress of heart disease classification embedded system. It provides a time diminution on electrocardiogram – ECG signal which can be practiced by decreasing the amount of data samples, without any significant loss. The objective of the urbanized system is the study of heart signals. The ECG signals are subjected onto the system that executes a preliminary filtering, and then utilizes a Gustafson–Kessel fuzzy clustering algorithm in order to exert for signal organization and correlation. The classification denotes usual heart diseases such as angina, myocardial infarction and coronary artery diseases. The system could also be used sudden "on duty" physicians, of any area of expertise, and could afford the first, or initial diagnose of any cardiopathy. If any system detects a heart problem, this system endows with better disease diagnose PPV evaluated to other testimonies, and therefore it tenders elevated assurance than other methods. Another foremost contemplation is the reality that this system was analogous to many other systems by accessing full data set, and this system exercised fuzzy clustering algorithm in order to diminish the data set, thus mitigating its use.

According to de Mirmozaffari Junior et.al Data mining [2], as a resolution to haul out hidden pattern from the scientific dataset is projected to a database in this research. The database consists of 209 occurrences and 8 attributes. The system was employed in WEKA and MATLAB software and prophecy accuracy within Apriori algorithm in just 3 steps, are compared. MATLAB is pioneer as better performance software. Wide ranges of Apriori algorithms" sturdy system in data mining were evaluated to predict heart disease. A sole model consisting of one filter and appraisal methods are evolved. Three strong rules, as well as different estimation methods, are applied to find the superior software. Apriori rules are measured concerning their actual number of supports, better accuracy, and considering strong rules. The high-performance software was introduced. The experiment can serve as a realistic tool for physicians to in effect predict uncertain cases and recommends consequently.

According to [3] presented a proficient advance for the forecast of heart attack from the heart disease database. Initially, the heart disease database is huddled using the K-means clustering algorithm, which will extort the data appropriate to heart attack from the database. This approach permits expertise the number of fragments through its k parameter. Consequently, the frequent patterns are excavated from the extracted data, relevant to heart disease, using the MAFIA (Maximal Frequent Item Set Algorithm) algorithm. The machine learning algorithm is modeled with the selected major patterns for the effectual prediction of heart attack. They have engaged the ID3 algorithm as the training algorithm to prove level of heart attack with the decision tree. The results showed that the designed prediction system is competent of forecasting the heart attack effectively.

According to [4] authors described about a prototype using data mining techniques mainly Naïve Bayes and WAC (Weighted Associated Classifier). The dataset is composed of important factors such as age, sex, diabetic, height, weight, blood pressure, cholesterol, fasting blood sugar, hypertension, disease. The system indicates whether patient had a risk of heart disease or not.

According to [5], authors proposed confidential scheme for predicting heart disease using two different models, Naive Bayes and Logistic Regression. As identified through survey, it is a need to have combinational approach to increase the accuracy of prediction for heart disease.   According to [6] authors proposed that, heart disease is one of the major causes of demise in the region of the world and it is essential to forecast the disease at a precipitate phase. The computer aided systems assist the doctor as a gizmo for forecasting and establishing heart disease. The intention of this paper is to extend about Heart related cardiovascular disease and to brief about accessible decision support systems for the computation and study of heart disease continued by data mining and hybrid intelligent techniques. Many DSS remains to predict the heart disease with several methodologies. The World life expectation statistics involve that heart disease has extended more in number. So, it is essential to construct an efficient intelligent trusted automated system which predicts the heart disease precisely based on the symptoms according to gender/age and province knowledge of experts in the field at the lowest cost.

According to [7] explicate that figures reveal that a heart disease is one of the foremost factors behind deaths throughout the world. Data mining techniques are pretty effectual in manipulative scientific support systems and having the capability to determine hidden patterns and relationships in medical data. Till now, Data mining classification techniques is applied to examine the various kinds of heart-based problems. This paper is intended at mounting a heart disease prediction system using data mining clustering methods. This paper crews the various clustering techniques, k-mean, EM and the farthest first algorithm for the prophecy of heart disease. End result proves that farthest first clustering algorithm is the finest algorithm as evaluate to other algorithms. Since the ratio of correctly classified occurrences to the cluster is highest and the time taken to construct the model is minimum. This system can be further extended. More number of input attributes can be used and it can be further expanded by escalating the no. of the clusters. The same experiment can also be performed on other data mining tool such as R. And also, the ensemble of classifiers can also be done to estimate their performance with the unique classifiers. Above algorithms can be subjected to other datasets in order to scrutinize whether the identical algorithm gives the highest precision or not. Authors in this paper [8] proposed the incorporation of accessing a clustering approach and regression methodology. The clustering approach used is DBSCAN and for regression, multiclass logistic regression is subjected. By executing DBSCAN clustering algorithm, the entire dataset is fragmented into disjoint clusters. Resulted clusters were found to enclose fewer occurrences are then taken for consideration. These clusters are focused to multiclass logistic regression. This result is due to the clustering approach acquired by an unsupervised process. Once regression is achieved, we have accomplished at a termination, about actual variety of cardiac arrhythmia it is. The projected method accomplishes an overall accuracy of 80%, when evaluated with various other existing approaches. It projects a method for the prophecy of type of cardiac arrhythmia by assembling the use of DBSCAN clustering and multi class logistic regression algorithms. By balancing PCACRA with other methods, this method is found to be 80% accurate.

Banu et.al. proposed [9] intends that large data existing from medical diagnosis is scrutinized by means of data mining tools and valuable information known as knowledge is hauling out. Mining is a method of investigating colossal sets of data to acquire the patterns which are hidden and formerly unknown associations and knowledge detection to facilitate the enhanced understanding of medical data to thwart heart disease. There are several DM techniques available namely Classification techniques concerning Naïve Bayes (NB), Decision tree (DT), Neural network (NN), Genetic algorithm (GA), Artificial intelligence (AI) and Clustering algorithms like KNN, and Support vector machine (SVM). Numerous studies have been conceded out for mounting prophecy model by accessing entity technique and also by coalescing two or more techniques. This paper offers a rapid and simple evaluation and perceptive of obtainable prophecy models by means of data mining from 2004 to 2016. In this paper, a survey conducted from 2004 to 2015 gives the scheme of various models obtainable and the various data mining methodologies used. The exactness gained with these models is also specified. It is pragmatic that all the techniques accessible have not use big data analytics. Exploiting of big data analytics along with data mining will offer talented results to get the finest precision in manipulating the prophecy model. Mane, Tejaswini U proposed [10] recommends that heart disease is one of the diseases due to that fatality will occur mostly, and according to the world health organization the percentage is high for that. So, Heart disease is determined for the big Data approach, and as Big Data is measured so use Hadoop Map diminish platform. For clustering improved K-Means and for the classification principle decision tree algorithm i.e. ID3 can be accessed in the hybrid approach. As second estimation is too better, the system is very helpful for the facilitating the forecast methods, based on some restrictions like chest pain, cholesterol, age, resting Bp, Thalac and many more. Due to this system medical decision making will be enhanced as well as being rapid. It's also will impact on the humanizing the treatment process. In such way it will be very helpful in the prophecy of the heart disease. In such way authors had cultured about the big data and its properties, with its disputes and concerns. In the medical field the various parameters individuals are affecting to the heart. Improved K-Means is the algorithm which is viewing the precision in the centroid assortment more than the simple K-Means.

III.PROPOSED SYSTEM

First system collects the current input states from each sensor, then convert it from Analog to digital using ADC, once conversion has done, it will be received by microcontroller, and at the same time it has stored into the database. The runtime monitoring system parallels real all events from database and show it to Graphical User Interface (GUI) then proposed machine Learning algorithm has works in the middle ware of system, It will always check all input values

from desired threshold, if any time values shows below minimum support as well as maximum resistance, then it will automatically executes the output appliances. At the same time system measure the activity state of dangerous level, system also measure the time count of specific state, and whenever it crosses the time scenario, it will execute the buzzer as well as GPS messaging system.
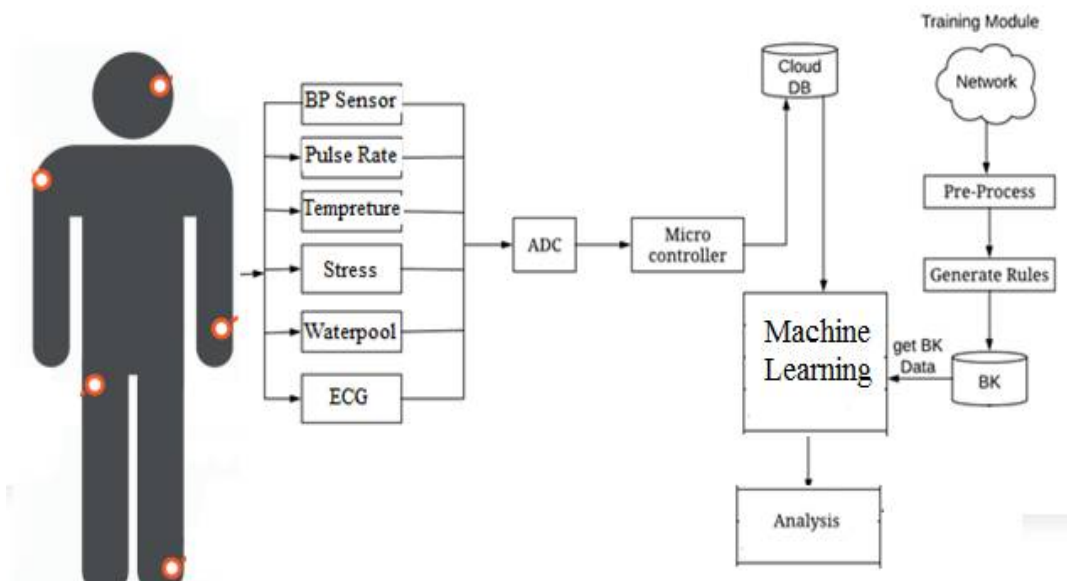

Figure 1: Proposed System Architecture.

Mainly proposed method has separated into two different phases, training and testing.
Training
- Gather information from internet similar to artificial information also actual time tolerant audit information.
- Concern information withdrawal approach like information pre-processing, information clean-up, information acquisition, outlier discovery also information alteration.
- Some time ago total this phase information has keep into the record called as backdrop information, which is use at the time of time testing.

Testing
- Primary scheme creates the IoT-based healthcare scheme surroundings wherever we use small number of sensors as wearable devices.
- After that we have associated every one sensor to Raspberry Pi, also gather information as of sensor suing lot allowance approach.
- Every one collected has built up into worldwide record by association-oriented design.
- In testing we study every testing also preparation information at the same time.
- Apply dissimilar classifiers also forecast the potential by choice creation system.

IV.SYSTEM ANALYSIS

RESULTS AND DISCUSSION:

The result analysis is the final phase of research which includes Experiments, results obtained and its analysis and discussions to come to conclusion. The research is conducted by conducting different experiments to check the efficiency of proposed algorithm in terms of various parameters like Size of dataset, Type of dataset, different input of algorithms.

The above figure 2 describes the false ratio of system with some algorithms; LR and I-Heart both consecutively generate the minimum false negative ratio
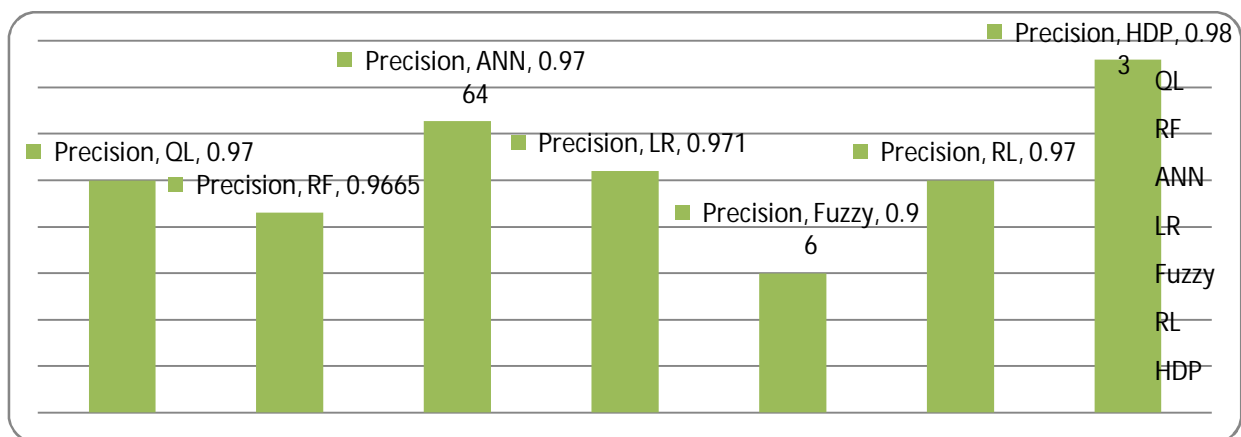.

Figure 2: Precision ratio of proposed system with multiple experiment

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V. RESULT AND DISCUSSION

In traditional approach what we found is most of the tests are invasive which gives irritation to the patients and this makes disappointment or carelessness towards their health. It's very impossible for them to manage with such conditions. Hence aim of this research is to provide them platform where each needy patient will get their vitals with proposed non-invasive approach. In this scenario, patient can get in touch with the doctor 24X7 with internet technology and alerted in case of emergency situations the implementation of machine learning algorithm provides the efficiency to the system, the system has implemented on various health care dataset.

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