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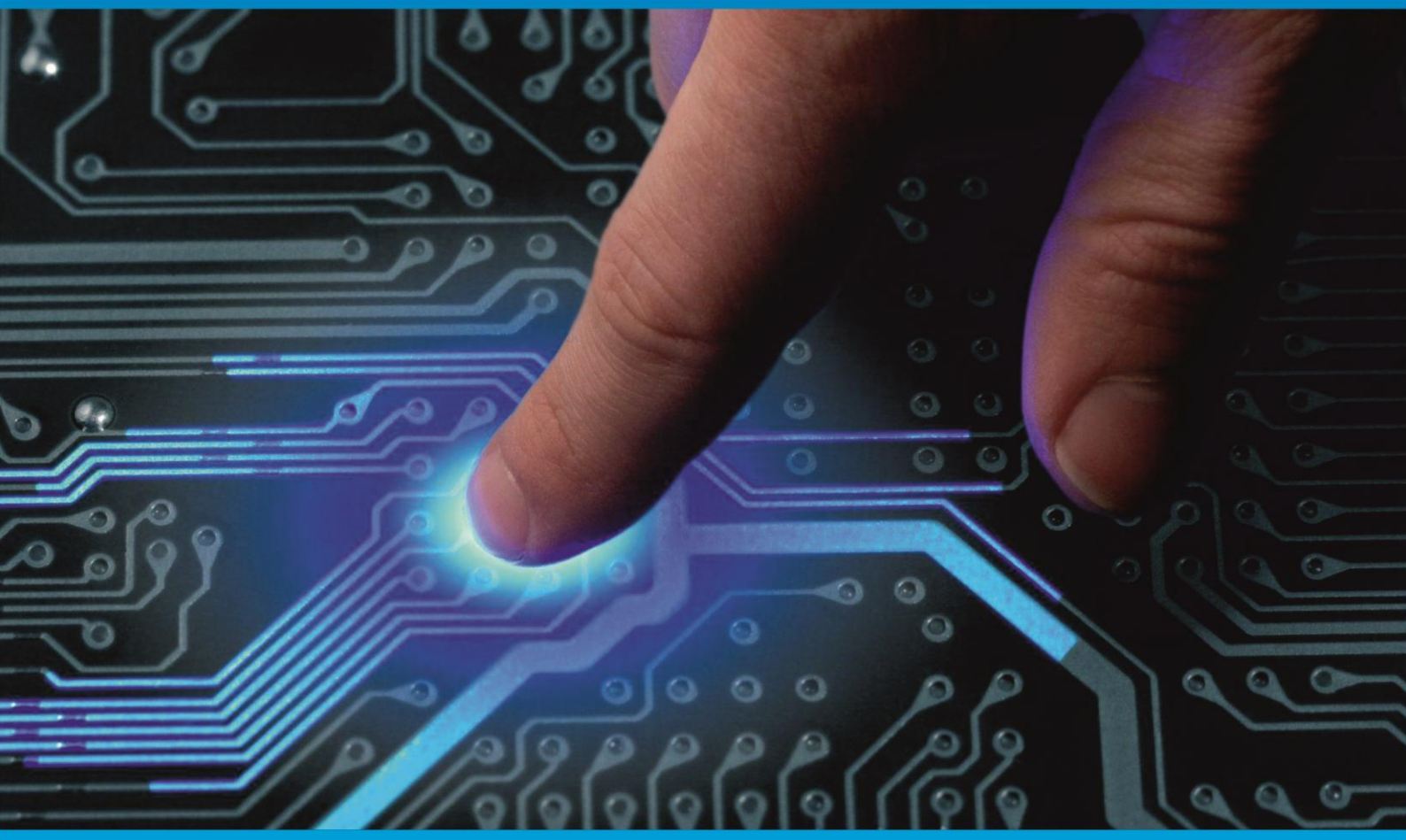

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Effective Heart Disease Prediction System using IoT and Machine Learning

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ABSTRACT: A healthcare system should give better healthcare services to people anywhere in an affordable and patient comfortably manner. Recently, the healthcare system is going to change from a old approach to a new patient centered approach. In the old way the doctors perform the main role. For necessary diagnosis and advising they need to visit the patients. The two basic problems related to this approach, very first the doctors compulsory should present at place of the patient for 24 hours and second, in the hospital, the patient remains admitted, wiring connected biomedical instruments to bedside, for long period of time. The patient friendly approach has received to solve these two problems. In this theme, the patients are aware with knowledge and information to play a more active role in disease diagnosis, and prevention. The important element of this second approach is a reliable and readily available patient monitoring system (PMS). Health is the globally challenging thing for human beings. According to the compositions of World Health Organization (WHO) the highest achievable standard of health is a important right for a single. One can secure his lifetime income by maintaining his health. Healthy persons can also reduce pressure on the already overloaded hospitals, clinics, and medical professionals and decrease the workload on the public safety charities, governmental or non-governmental centers and networks. To human being healthy, a readily easy going modern healthcare system is essential.

KEYWORDS : Heart Disease prediction, IoT system, Machine Learning,

I. INTRODUCTION

Many people in the world suffer from chronic problem of diabetes and then automatically prone to heart disease with high or low blood pressure. It depresses the patient as he/she must run the life on medical prescriptions which totally disturb health status. Hence, we need adopt the new technologies which will assist a doctor in his absence and patient should also feel safe. Hence Proposed framework will introduce the support system for the doctor in his absence virtually he can observe the patients' health parameters with the help of android application development wherein obviously physical perception of experienced cardiologist will play a vital role for verification of diagnosed results. From the concerned literature for smart medical monitoring devices, it appears that there is need for society to increase safety of human lives and health in case of event of irregularities for heart, immediate response from qualified person like doctor may help to avoid any unpleasant consequences to happen. This is an effort taken for the people who live alone and become unattended which require continuous monitoring for sake of their life.

Effective integration of internet of things and wearable technology or synthetic dataset, the expected outcome is in terms of inculcating efficiency of heart for the risk out patient.Proposed system has the capability of simultaneous monitoring multi parameters integrated with single chip onto wearable devices where multiple sensors work together to obtain required data excluding noise disturbances. It works to maintain its accuracy by reducing less human interventions. It is real time diagnostic system for remotely located heart prone patients to measure heart rate, blood pressure, body temperature and many other parameters using biomedical sensors. N number of collected observations can be stored and viewed later by physicians for correct diagnosis purpose.

Machine learning approach will sensitize and analyzed the trained data for inculcating heart efficiency. Two major interfaces for doctor and patient will enable the transfer the information to each other. This framework detects underlying heart conditions in real time for sake of patient's life and generates alarm in sense of SMS, Email etc. based on high and low threshold values set a right for doctor as well as for responsible registered any family member. This will enrich the system with feeling of attention, care which add value to patient's health. This approach attempts to evolve with know-how relationship between doctor and patient. Instead of purchasing different devices at different prices, this invention helps to reduce the cost. Also, hospitalization cost will also get reduced as this is one-time investment. Number of times we can take the readings. This invention gives exact status of our heart to know if 32 years am old, my heart functionality is like 32 years or older than that.

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II. LITERATURE SURVEY

Authors have shown an analysis by using a Decision tree, K- nearest neighbour, random forest, and support vector machine classifiers. Before pre-processing J48 showed the highest efficiency while after pre-processing, KNN and random forest showed the highest accuracy. An analysis is done on PIDD before and after pre-processing [1].

In [2], the authors proposed a framework to predict disease using machine learning and deep learning techniques on the PIDD dataset. Artificial Neural network (ANN) has got the highest accuracy as deep learning technique, and the Random Forest technique has got the highest precision in machine learning techniques.

In [3], the authors compared multiple prediction models using health checkups, and insurance claims data. Yearly health checks up and health insurance dataset from japan is used. XGBoost algorithm is used to predict Type2 diabetes and has got the highest accuracy.

In [4], the authors discussed diabetic research on 1) prediction and diagnosis, 2) Diabetic complications, 3) Genetic background, and environment and 4) Health care and management. Various methodologies are used as feature extraction and reduction using LDA (Linear Discriminant analysis) - MWSVM for diabetes diagnosis, Ant colony classification used set of fuzzy rules to extract features, multivariate regression using support vector regression, fuzzy ontology-based case reasoning, multilayer classification and rotation forest on various datasets like clinical and biological datasets, gut microbiota, Electronic measurements of saliva, demographic, Anthropometric, diagnostic and clinical laboratory measurements and it is observed that SVM has got the highest accuracy among all classifiers. They have also discussed on macrovascular and microvascular diabetic complications, for these researchers used temporal data mining and machine learning algorithms for risk stratification.

In [5], the authors derived a set of predictive models of type2 diabetes complications based on electronic health record, and model validation is done. To deal with missing values and class imbalance in RF, Stepwise feature selection is made with the logistic regression. Various Classification models are used like Logistic regression, Naïve Bayes, Support vector machine and random forest. A risk score is scored based on the temporal threshold, complications, and onset date registered. Clinical Historical dataset for more than ten years has taken from the hospital of Pavia, Italy is considered. The final model taken has got an accuracy of 83%.

Methods used are center, profiling, predictive models training, predictive models construction and predictive models validation. In center profiling optimize features are selected to do an initial analysis. In predictive models training, focused on microvascular complications like nephropathy, neuropathy and retinopathy. In predictive models construction, after the first visit, the patient is predicted whether he will develop microvascular complications or not ?, got the best results for retinopathy and neuropathy cases.

In [6], the authors predicted incident of diabetes using medical records of cardiorespiratory fitness. Methodologies like Data preprocessing, features selection, multiple linear regression, information gain ranking is done using a Decision tree, Naïve Bayes, Logistic regression and random forest on the Henry ford fit dataset (Patients who underwent treadmill stress). To handle imbalanced datasets, the Synthetic minority over- sampling technique (SMOTE) was used. Combined three classifiers i.e. RF, NB, and LMT, and has got an accuracy of 92% achieved higher accuracy of 3.04% compared to other researcher's prediction model. Efficiently predicted cardiorespiratory fitness data using ensemble machine learning and SMOTE methods.

In [7], authors did an enhancement in prediction model and have got an accuracy of 95% on PIDD and other two datasets as Donated by Dr.Schorling from the Department of Medicine of the University of Virginia School of Medicine and collected an online questionnaire. Improved K – means algorithm is used to remove incorrectly clustered data and to get an optimized dataset where preprocessing is done, and Logistic Regression is used to classify remaining data i.e., whether a person has diabetes or not. Data mining toolkit is used where preprocessing, classifying, ranking algorithms, and the visual interface is done. 10 fold cross -validation is used so that it reduces the bias associated with the random sampling method. The model is evaluated by the confusion matrix. The Mathews correlation coefficient (MCC) is used are the measure of binary classification. Kappa statistics is used to test the consistency of the model.

In[8], Dimensionality is reduced using Principal Component Analysis and minimum redundancy maximum relevance(mRMR) to avoid redundant features Decision Tree – C4.5, Random forest, and the Neural Network used as classifiers, 5 fold and 10- fold cross validation method is used on PIDD and physical examination clinical dataset received in Luzhou, China. The Random forest has got the highest accuracy of 80%. RF is a multifunctional machine learning method and plays a significant role in the ensemble machine learning method. Compare to PCA, mRMR has got the best efficiency.

In [9], the authors developed a deep learning model for retinopathy detection. Various color retina images dataset was taken from the kaggle website. Feature extraction is done using the Convolutional Neural network, and SVM, and KNN classifiers are used for detection. The proposed CNN model achieved good results in discovery. The proposed model used regression activation mapping (RAM) to get more accurate results.

In [10], the authors designed a prediction model. They selected significant attributes by giving sequences to each attribute and used classifiers like J48, Random Forest, Naïve Bayes, MLP, KNN, and Neural network. PIDD dataset is used and based on the best attribute selection, the result of classification techniques are improved. Naïve Bayes has shown the average accuracy which is the highest among all of 82.30%. Features are mapped effectively from low to high dimensions.

III. PROPOSED SYSTEM DESIGN

First system collects the current information states from every sensor, at that point convert it from Analog to computerized utilizing ADC, when change has done, it will gotten by microcontroller, and in the meantime it has put away into the database. The runtime observing framework parallels genuine all occasions from database and show it to Graphical User Interface (GUI) at that point proposed AI calculation has works in the center product of framework, It will dependably check all information esteems from wanted limit, if whenever qualities appears underneath least help just as greatest opposition, at that point it will naturally executes the yield machines. In the meantime framework measure the movement condition of hazardous dimension, framework additionally measure the time check of explicit state, and at whatever point it cross the time situation, it will execute the bell just as GPS messaging system.

Once IoT system has enabled it will generate temperature and Pulse rate in a specific time interval and sends to ADC and it forward to Raspberry pi, the details information has given below.

- ADC convert those values from analogue to digital and transfer to power Raspberry Pi, at the same time we have written the script which will post this data into the cloud server.
- In our Java web application we continuously monitoring active patient data in web GUI.
- The Q-learning base machine learning algorithm has implemented to predict the dangerous event according to the given parameters, system will send alert message automatically when number of penalties given by algorithm to generated data.
- If Q-learning sends dangerous alert to cloud server it will automatically shown on doctor's device with entire patient information.
- This system also able to eliminate DOS as well as MiM attacks simultaneously, in DOS system trash whole dataset and MiM which change actual value of temperature and Pulse rate.

Power prevention mechanism will eliminate those attacks and provides original data to our system.

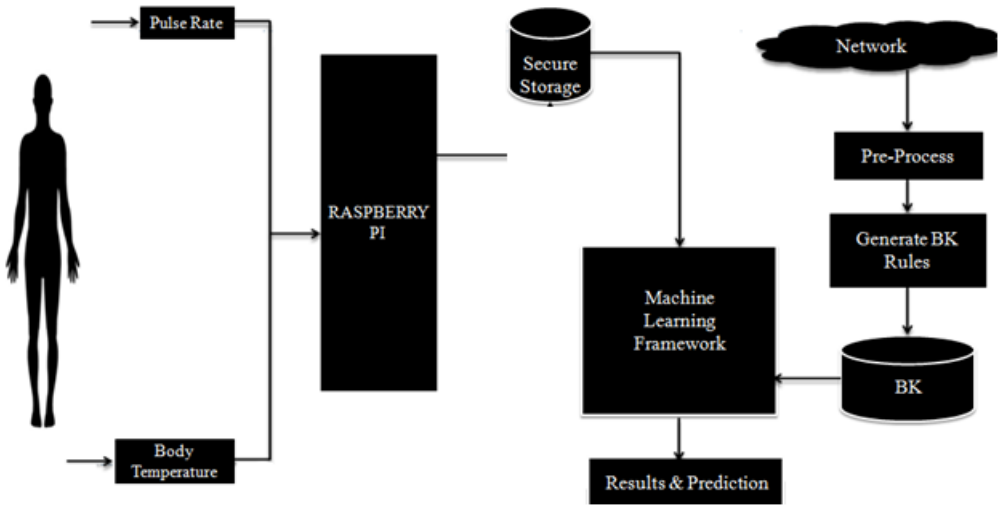

Figure1 : Proposed system design

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IV. ALGORITHM DESIGN

Algorithm 1 :Q- Learning Algorithm

Input: inp[1…..n] all input parameters which is generated by sensors, Threshold group TMin[1…n] and TMax[1…n] for all sensor, Desired Threshold Th.

Output: Trigger executed for output device as lable.

Step 1 : Read all records from database (R into DB)

Step 2: Parts [] ← Split(R)

Step 3:

$$CVal = \sum_{k=0}^{n} Parts[k]$$

Step 4: check (Cval with Respective threshold of TMin[1…n] and TMax[1…n] **)**

Step 5: T← get current state with timestamp

Step 6 : if(T.time> Defined Time)

Read all measure of for penalty TP and reward FN

Else continue. Tot++

Step 7: calculate penalty score = (TP *100 / Tot)

Step 8 : if (score >= Th)

Generate event

end for

V. RESULTS AND DISCUSSIONS

vThe proposed framework has conveyed with various java and in addition Mobile base android platform. Beneath figure demonstrates that the recognize component really builds information loss for the ECG sensor (it could be helpful for bring down information rate sensors), while pressure emphatically expands the quantity of ECG gadgets that can be all the while utilized for a given packet loss rate. Here x axis show the no. of users and Y shows the average packet loss from ECG device, the below Figure 3 shows the system accuracy with different no experimental test analysis.

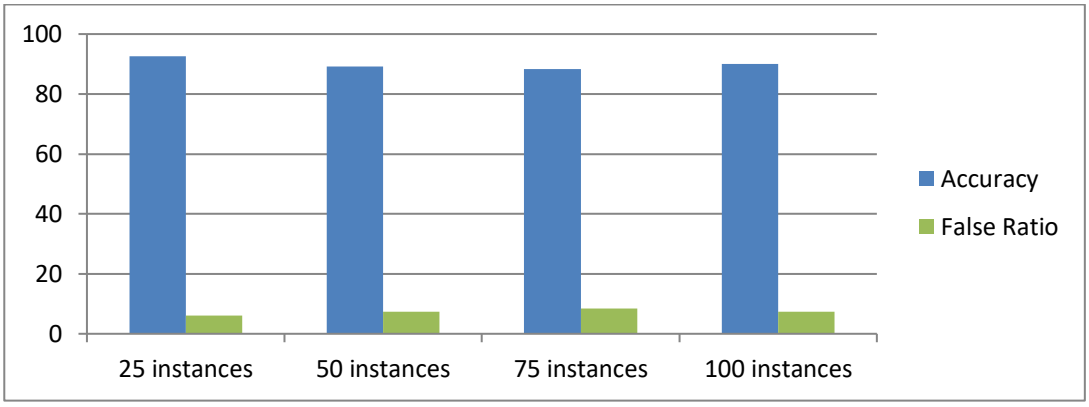

Figure 2: System accuracy of proposed system with false ratio.

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VI. CONCLUSION AND FUTURE WORK

Internet of Things Framework is essentially a well running technology because it provides the common platform to the ordinary man who can afford it at reasonable cost in many of the refinery areas. In this above discussed research area called as healthcare is an essential and unavoidable region of our day to day life. Under this medical domain, IOT gives stronger platform to assemble the sensory data and put them into smart devices consists of super brilliance gives best surveillance to the needy one. This is the core level of intellectual reasoning to the android devices or may be called as smart gadgets. 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. In accordance with proposed framework, we can able to manage with cholesterol, blood pressure, stress indicators and many more such parameters which are necessary to mine exact heart health which also encompass vascular age and cardiac index for the same.

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