International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 09 | Sep 2020 www.irjet.net p-ISSN: 2395-0072

Remote Medical Analytic and Alert System

Akshatha M N[1], P M Shivmurthy[2]

[1]*M.Tech Student, Dept. of Computer Science, JSS Science & Technology University, Karnataka, India*
[2]*Assistant Professor, Dept. of Computer Science, JSS Science & Technology University, Karnataka, India*

Abstract - *Heart disease is the leading cause of death among all other diseases, even cancers. The number of men & women facing heart disease is on a raise each year. This prompts for its early diagnosis & treatment. So our main focus is to train a system to predict heart disease along with its stages without a human intervention. Our model is trained by applying two machine learning algorithm. On algorithm for the prediction of heart disease-decision tree and another one for the prediction of the stages of heart disease. Here we have considered dataset with 13 attributes which are related to heart where in each of the attributes contribute to the prediction. Mainly 2 attributes values are collected in equal interval of time that is BP and heart rate.*

Our system works as a real-time application. Thus during emergency patient current status will be send as the caution to patient's guardian and patient's related doctor. The geo-graphical location of patient is also shared with the parent's guardian and patient related doctor. It also extends to find the nearest ambulance to the patient's location and share the patient's location details with it. So that patient will be taken care immediately and further treatment can be started without a delay.

Key Words: **Heart disease prediction with stages, decision tree, naive bayes algorithm, haversine formula**.

1. INTRODUCTION

Today's era is mainly witnessing an health issues due to many factor including lifestyle, obesity, stress, hypertension, etc. Among which, heart disease is at the top which causes the death in vital part of the world. Heart disease includes disease related to heart muscles, valves, conduction system, heart attack &other. Heart disease is now commonly known in all ages group from a new born baby to aged people wherein a higher percentage of heart disease will be more on the aged people than any other. Myocardial infarction or well known as heart arrest is one of the major.

Heart disease is also known to be a silent killer due to which most of death without obvious symptoms. Due to this nature of the disease people are more tensed about the disease and its consequence. Hence continues efforts are being made for the prediction of the different possibility of this disease in prior. Different tools and technique are being experiment on it. Machine learning emerge has a boon in this regard where its technique is applied on it. For sure regardless of the way that heart ailment can occur in a few shapes, there's a typical arrangement of focus chance factors that sway whether someone will in the long run be at danger for heart contamination or not. By gathering the data from various sources, grouping them underneath reasonable headings and finally dissecting to remove the predetermined data prepared to come to an end result. This technique can be incredibly composed to the do the desire for heart disease. As the notable refer to says "Counteraction is the way better at that point fix", early gauge and its control can be steady to keep away from and reduce the passing rates because of heart ailment Coronary illness suggests equivalent to heart malady. Contingent on the pathology occurred, the heart sickness are of various structures.

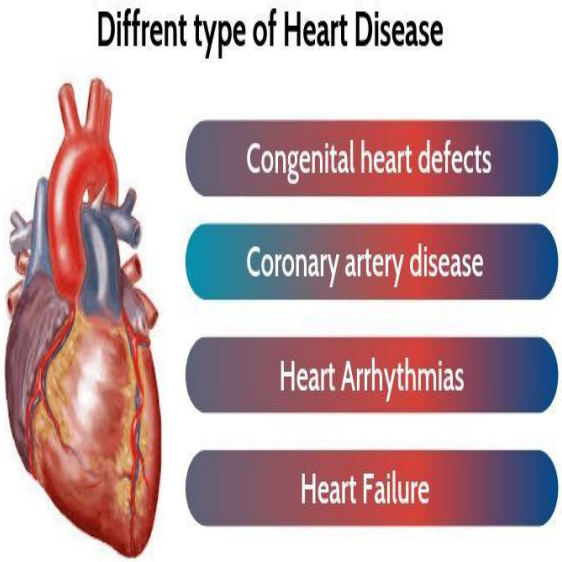

Fig 1: different type of heart disease

1.1 Types of heart disease

Sl no	Disease name	description	Symptoms
1	Coronary artery disease	Also known as Ischemic heart disease. Hardening of the vessel that go to the heart.	3/4 Chest pain 3/4 heart burn ¾ breathing problem

2	Heart attack	Also known as Myocardial infraction. Obstruction of blood flexibly to a segment of heart heading to damage to the heart muscle.	Chest pain spreads to shoulder, neck, back or jaw. Chest pain is mostly on life side
3	Arrhythmia	Commonly called as irregular heartbeat. Either the heartbeat will be high or medium or slow	Heart beat variation
4	Heart failure	Inadequate supply of blood from d heart to body	Difficulty in breathing. Fatigue Leg swelling

Table 1.1 Different Types of heart disease

1.2 Blood pressure

The blood pressure is the pressure of the blood within the arteries. It is produced primarily by the contraction of the heart muscle. It's measurement is recorded by two numbers.

1. Systolic pressure -occurs as blood pumps out of the heart and into the arteries that are part of the circulatory system.
2. Diastolic pressure -created as the heart rests between heart beats.

Wherein systolic pressure is taken to be a major concern.

BLOOD PRESSURE CATEGORY	SYSTOLIC mm Hg (upper number)		DIASTOLIC mm Hg (lower number)
NORMAL	LESS THAN 120	and	LESS THAN 80
ELEVATED	120 - 129	and	LESS THAN 80
HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 1	130 - 139	or	80 - 89
HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 2	140 OR HIGHER	or	90 OR HIGHER
HYPERTENSIVE CRISIS (consult your doctor immediately)	HIGHER THAN 180	and/or	HIGHER THAN 120

Fig 1.2: blood pressure chart

2. Literature Survey

1) Cloud based Intelligent Healthcare Monitoring System, 2014, Mr.KhyamlingAParane, Mr.Naveenkumar C Patil, Mr.Shivananda R Poojara, Mr.Tejaskumar S Kamble

Cloud based Intelligent Healthcare Monitoring System (CIHMS) is the joining of distributed computing and wellbeing checking. The destinations of paper are cloud based medical care framework must be more reasonable and attainable as far as giving master based clinical consideration. To utilize versatile and remote advancements that offers some energizing open doors for an ease. To convey wellbeing advancing messages in a non-interruptive style through a remote body-region network. The generally speaking perception is that the paper talks about the recreation of essential medical services framework on intranet and the multidisciplinary try, for example, cloud for medical services frameworks that gives more prominent advantages to patients and hospitals. Computation of clinical information gathered from the sensors is done subsequent to putting away it on cloud. This devours a great deal of time which isn't adequate [1].

2) Vanishree K,Jyothi Singaraju, *"Decision Support System for congential heart disease diagnosis based on signs and symptoms using neutral network"* International Journal of computer applications, April 2011 Vol 19 no.6.

The paper by Vanishree. K built up a framework for finding of innate coronary illness utilizing choice emotionally supportive network. It utilized Back engendering Neural Network with MLP. It depended on the information – indications of the coronary illness, manifestations and aftereffect of assessment got from the patient. It demonstrated 90 % exact outcomes [2].

3) C. D. Katsis, I. Gkogkou, C.A. Papadopulos, Y.Goletsis, P. V. Boufounou, G. Stylios *"Using artificial immune recognition systems in order to detect early breast cancer."* International Journal of Intelligent Systems and Applications 5.2 (2013): 34.

C.D. Katsis et al study devised ways using Correlation Feature Selection (CFS) procedure & an Artificial Immune Recognition System (AIRS) classifier to diagnose breast cancer. Data for the study was collected from 53 patients among the 4726 cases. Biopsy was taken in all the patients & it was kept as standard parameter to validate the methodology. The features along with the biopsy result were used for the analysis in 53 patients. Adoption of SVM technique resulted in 70.00 + 6.33% accurate result [3].

3. Proposed System

In this paper, the proposed system is trained to predict heart disease along with its stages. This is accomplished by applying two machine learning on the dataset considered.

Two machine algorithm are :decision tree, naive Bayes. Decision tree is applied firstly to predict whether the patient has a heart disease or not. The decision tree is also known to be classifier algorithm thus the patient is classified under any one of the two classes: yes, no. if the result of a tree is true(yes) then patient has a heart disease. Then further naive Bayes algorithm is applied on the patient record to find the stage of the heart disease . If the decision tree result is false(no) then the patient doesn't have heart disease.

Our system collects the BP and heart rate at the equal intervals of time. By reading this value, patient is considered to be emergency case or not. If value is lesser\greater than normal range than patient is considered to be emergency. The system alerts patient guardian and patient related doctor about patient current status.it shares the patient current location with the patient guardian, patient related doctor and map to a nearest ambulance.

1.1 Data base design

The dataset is basically patient pathology report. The data set contains 13 attributes which include sex, serum cholesterol level, resting ECG etc. This data set is being stored using MYSQL database. It plays the role of a DB server .Its collected from UCI .website

1. Age : shows the age of the person.
2. Sex : shows the sex of the individual utilizing the accompanying organization :
   - 1 = male
   - 0 = female
3. chest-torment type : shows the sort of chest-torment experienced by the individual utilizing the accompanying organization :
   - 1 = common angina
   - 2 = atypical angina
   - 3 = non - anginal agony
   - 4 = asymptotic
4. Resting Blood Pressure : shows the resting pulse estimation of a person in mmHg (unit)
5. Serum Cholesterol : shows the serum cholesterol in mg/dl (unit)
6. Fasting Blood Sugar: looks at the fasting glucose estimation of a person with 120mg/dl.

If fasting glucose > 120mg/dl at that point : 1 (valid)
else : 0 (invalid)

7. Resting ECG :
   - 0 = typical
   - 1 = having ST-T wave anomaly
   - 2 = left ventricular hypertrophy
8. Max pulse accomplished : shows the maximum pulse accomplished by a person.
9. Exercise initiated angina :
   - 1 = yes
   - 0 = no
10. ST sorrow incited by practice comparative with rest : shows the worth which is number.
    Peak practice ST portion :
    - 1 = upsloping
    - 2 = level
    - 3 = down sloping
11. Number of significant vessels (0-3) hued by fluoroscopy : shows the incentive as whole number or buoy.
12. Thal : shows the thalassemia :
    - 3 = typical
    - 6 = fixed imperfection
    - 7 = reversable imperfection
13. Diagnosis of coronary illness : Displays whether the individual is experiencing coronary illness or not :
    - 0 = nonappearance
    - 1,2,3,4 = present

1.2 Algorithm

In this paper, our aim is to predict the heart disease along with its stages based on pathology's report of the patient that is considered to be dataset. To train our system we have used dataset available in UCI. System is trained to apply two machine leaning .
Two machine algorithm applied on the dataset are:

- Decision tree
- Naive Bayes

Where in both are not applied simultaneously. Naive bayes algorithm is applied based on the result of decision tree.

I. Decision tree

Decision tree algorithm is one powerful technique for classification problem. There are two phases in this methodology gathering a tree and applying the tree to the dataset. There are various popular decision tree figuring CART, ID3, C4.5, CHAID, and J48. From these J48 count is used for this system. J48 estimation uses pruning procedure to collect a tree. Pruning, a strategy that decreases size of tree by killing over fitting data, which prompts powerless precision in predications. The overall thought is to gather a tree that gives equality of versatility and accuracy.

Pseudocode of decision tree:

Calculate detection="yes", detection="no"

probabilities Pyes, Pno from training input.

For Each Test Input Record for Each Attribute

Calculate Category of Attribute Based On Categorical Division

Figuring Probabilities of Detection="Yes", Detection="No"

Compares To That Category P(Attr, Yes), P(Attr, No) From Training Input.

For Each Attribute

Calculate the Predictyes= Predictyes* P(Attr,Yes),

Predictno=Predictno*P(Attr, No);

Calculate Predictyes= Predictyes *Pyes

Predictno=Predictno*Pno;

If(Predictyes > Predictno)

Then Detection="Yes";

Else Then Detection ="No";

II. Naïve Bayes

Naïve Bayes is one of powerful machine learning algorithm which is based on the "Conditional Probability". This Algorithm is framed by the mix of two words "navie" + "Bayes". The calculation is called Naïve because it assumes that the features in a class are random to different features and every one of them autonomously add to the likelihood calculation. Thus after prediction of heart disease whether the patient has a heart disease or not found out by applying decision tree using all the attribute of dataset. We now apply the naive Bayes algorithm to know the stage of heart disease if and only if the patient has a heart disease thus decision tree condition is true.

Naive Bayes' algorithm steps:

1. **Scan the dataset which consisted of 13 attributes (ds in server)**
2. **Calculate the probability for each attribute values. [n, n_c, m, p]**
3. **Apply the formulae**

P(attributevalue(ai)/subjectvalue (vj))=(n_c+mp)/(n+m)

Where:

- **n = the number of training e.g. for which v = vj**
- **n_c = number of e.g. for which v = vj and a = ai**
- **p = priori estimate for P(aij vj)**
- **m = sample size**

4. **Multiply the probabilities by p.**
5. **Compare the values and classify the attribute values to one of the predefined set of class.**

Haversine formula

The Haversine formula calculates the shortest distance between two points on a sphere using their latitudes and longitudes measured along the surface . Haversine formula is used to calculate shortest distance between patient location and ambulance available. From this nearest ambulance can be found and can be used for patient shifting to hospital. It is important for use in navigation. The haversine formula to find distance:

$$d = 2r\sin^{-1}\left(\sqrt{\sin^2\left(\frac{\Phi_2-\Phi_1}{2}\right)+\cos(\Phi_1)\cos(\Phi_2)\sin^2\left(\frac{\lambda_2-\lambda_1}{2}\right)}\right)$$

where r is the radius of earth(6371 km),
d is the distance between two points,
$\phi 1, \phi 2$ is latitude of the two points,
$\lambda 1, \lambda 2$ is longitude of the two points

1.3 Implementation details

Our proposed work is been implemented using c# and java programming language. C# is an object oriented language which is used majorly. our proposed system has been divided into 2 phase. Firstly its an web-based application and also secondly, its android application.

In web based application ,actor included are doctor and admin. This data is been maintained by standard authorities like hospital, health care center etc. Admin is considered to be trustworthy who is responsible for adding patient info, creating doctor's profile and ambulance profile. Doctor can view patient info and add patient treatment details for the further use.

In an android app part, actor are patient guardian, doctor and ambulance driver. App is installed in the mobile to view the patient status and also the patient geo-graphical location.

1.4 Result Analysis

Proposed work is implemented and tested on the dataset consisting of 1573 patient record. Proposed system is implemented on the pc with the configuration of above i3 generation and mobile of configuration above android 5.0 version.

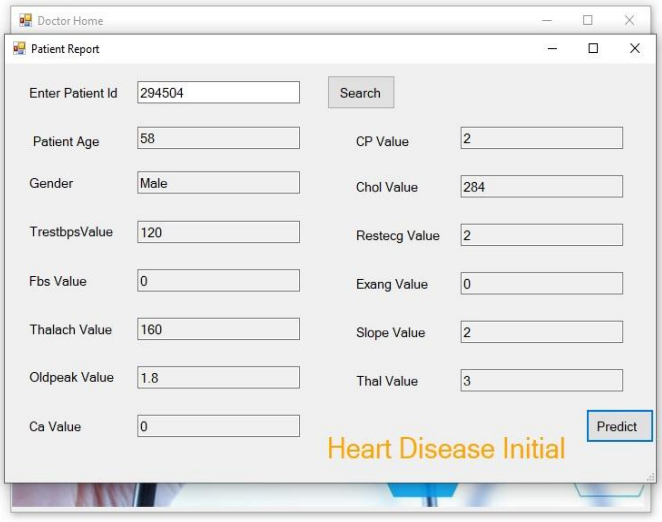

Fig 1.3: Heart disease prediction with its stage

The above fig 1.3 indicates the snapshot of the heart disease prediction along with its 4 stages. That is initial, stage 1, stage 2 and stage 3. Heart disease is predicted by applying decision tree on the dataset consisting of 13 attribute of patient related to heart disease. The data set is evident from the pathology.

The fig 1.4 indicates the display of push notification to patient guardian and patient related doctor during emergency of the patient is recorded. Patient current status is displayed along with it. Fig 1.5 display the patient's geo-graphical location that is shared with the nearest ambulance to the patient's location. Firstly, it calculates the distance from the patient current location to the ambulance available at that time. The one with least value is considered to be the ambulance nearer to patient's location. Here google map is used to find the route to patient's current location.

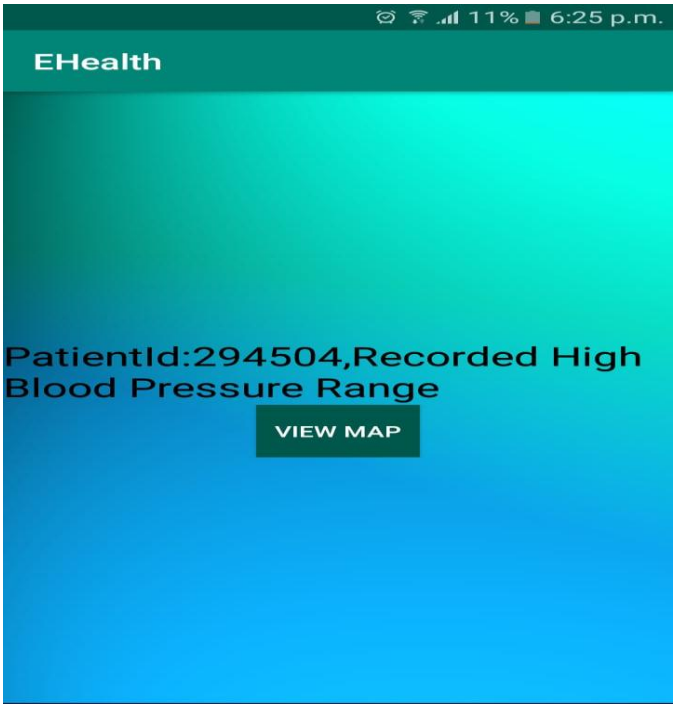

Fig 1.4: Display of push notification to patient guardian and patient's doctor in mobile

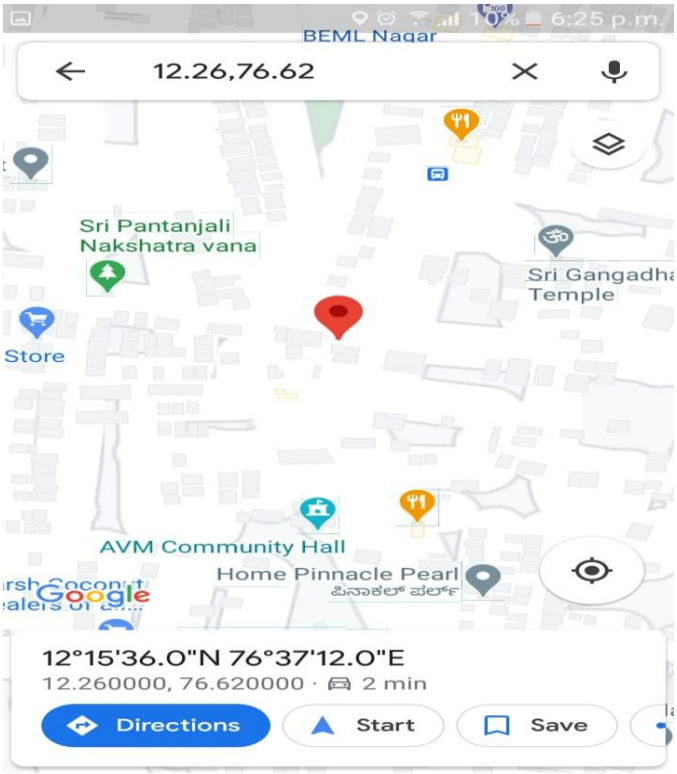

Fig 5: Display of patient's geo-graphical location shared on with ambulance driver using g-map

5. CONCLUSIONS

The overall objective of our work is accomplished successfully by predicting heart disease along with its types/stages. Here dataset is consist of 1573 patient record which is of from UCI repository. Two machine learning algorithm is applied on the dataset. Decision tree is applied on a dataset to predict the heart disease and naive Bayes algorithm is applied to predict stage of an heart disease. During emergency patient guardian and doctor are intimated with patient current status. Patient geo-graphical location is shared with nearest ambulance with help of g-map.

The system can be further enhanced with more number of inputs. Different machine learning can be used for prediction.

REFERENCES

[1] Cloud based Intelligent Healthcare Monitoring System, 2014, Mr.KhyamlingAParane, Mr.Naveenkumar C Patil, Mr.Shivananda R Poojara, Mr.Tejaskumar S Kamble..

[2] Vanishree K,Jyothi Singaraju,"Decision Support System for congential heart disease diagnosis based on signs and symptoms using neutral network" International Journal of computer applications,April 2011 Vol 19 no.6.

[3] C. D. Katsis, I. Gkogkou, C.A. Papadopulos, Y.Goletsis, P. V.

Boufounou, G. Stylios "Using artificial immune recognition systems in order to detect early breast cancer." International Journal of Intelligent Systems and Applications 5.2 (2013): 34.

[4] Priyanka N., Pushpa Ravi Kumar. "Usage of data mining techniques in predicting the heart diseases — Naïve Bayes & decision tree", 2017 International Conference on Circuit, Power and Computing Technologies (ICCPCT), 2017.

[5] Khyamling A. Parane, Naveenkumar C. Patil, Shivananda R. Poojara, Tejaskumar S. Kamble. "Cloud based Intelligent Healthcare Monitoring System", 2014 International Conference on Issues and Challenges in Intelligent Computing Techniques (ICICT), 20.

[6] itsws-training.blogspot.com.

[7] Khyamling A. Parane, Naveenkumar C. Patil, Shivananda R. Poojara, Tejaskumar S. Kamble. "Cloud based Intelligent Healthcare Monitoring System", 2014 International Conference on Issues and Challenges in Intelligent Computing Techniques (ICICT), 2014.

[8] L. Burke, J. Ma, K. Azar, G. Bennett, E. Peterson,Y. Zheng, W. Riley,J. Stephens, S. Shah, B. Suffoletto, T. Turan, B. Spring, J. Steinbergerand C. Quinn, "Current Science on Consumer Use of Mobile Healthfor Cardiovascular Disease Prevention", Circulation, vol. 132, no. 12,pp. 1157-1213, 2015.

[9] M. Raihan1, Saikat Mondal2, Arun More3, Md. Omar Faruqe Sagor4, Gopal Sikder5, Mahbub Arab Majumder5, Mohammad Abdullah Al Manjur5 and Kushal Ghosh, "Smartphone Based Ischemic Heart Disease (Heart Attack) Risk Prediction using Clinical Data and Data Mining Approaches, a Prototype Design", International Conference on Computer and Information Technology, December 18-20, 2016.

[10] S.Kharya, D. Dubey, and S. Soni - Predictive Machine Learning Techniques for Breast Cancer Detection, (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 4 (6), 2013, 1023-1028.

[11] Ms. Ishtake S.H, Prof. Sanap S.A., ''Intelligent Heart DiseasePrediction Sy stem Using Data Mining Techniques'', International J. of Healthcare & Biomedical Research,Volume: 1, Issue: 3, April 2013, Pages 94-101.

[12] G. M. Nasira, N. Hemageetha, ''Vegetable Price Prediction Using Data Mining Classification Technique'', Proceedings of the International Conference on Pattern Recognition, Informatics and Medical Engineering, March 21-23, 2012.

[13] https://www.igismap.com/haversine-formula-calculate-geographic-distance-earth/.