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Dear Researcher,

Greetings!

Articles in this issue discusses about study endeavours to recent trends in E-Banking.

We look forward many more new technologies in the next month.

Thanks,
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IOT-BASED HEALTHCARE SYSTEM ON SMART STICK FOR THE VISUALLY IMPAIRED

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***Abstract*— Wireless advancements is gadget simplicity, and sensor technologies are examples of technological advances. It has made it possible to build and grow wireless sensor networks with networking capabilities that can independently monitor and control their environment. The goal of this program is to link everything that may be accessed from anywhere on the Internet. IoT applications are not limited to a single field. It has demonstrated a significant contribution from small scale applications to large scale applications in areas such as e-commerce, coal mining, wearable devices, smart grid, healthcare system, military, laboratory monitoring, agriculture, and many other domains. Wireless Body Area Network for Blind IoT using (WBANB). IoT enables early identification of any aberrant physiologic signals, electronic health monitoring for blind people is very helpful tool in dangerous circumstances. It is built inside the smart stick and also functions as an object detector, which is also built into this stick. The World Health Organization (WHO) estimates that 43 million people are blind. There are 295 million people in the world who have moderate to severe visual impairment. Mild visual impairmed affects 258 million individuals, and Near-sightedness affects 510 million people. In this paper, we look at how wireless healthcare networks are becoming more popular in this day and age of communication technology. Utilities are given greater monitoring tools for blind patients in order to improve their quality of life.**

Keywords— IOT, Sensors, BP-WBAN, Node MCU, Networking.

1. INTRODUCTION

The Internet of Things (IoT) is a brand-new technology paradigm that has piqued the curiosity of academics from a variety of fields. IoT devices include wireless sensors, particular programs, computer devices, and other IoT devices. They are linked to a specific object and function through the internet, allowing data to be delivered automatically and without human contact between individuals or products. This innovative technology has the potential to transform low-cost healthcare applications, such as blind patient health. Blind patients are linked to specialists all around the globe through Internet- connected technologies. In healthcare, the IoT enables the monitoring of glucose levels and heart rates, in addition to basic hydration tests. In general, in healthcare, the IoT is employed in (i) critical treatment circumstances; (ii) blind patient testing and routine medication; (iii) crucial treatments by connecting some machines to blind patients; and (iv) blind patient data interchange through the cloud. The first suggestion for incorporating IoT into healthcare is to employ smart devices to connect physicians and patients while each individual is free to travel [1]. There are three sorts of gadgets: consumer, business, and industrial. Consumer IOT tools contribute to both industrial goals and better blind people's healthcare, as well as reaching all lower- and middle-class individuals. Because of IOT, a type of network that connects internet-connected things to build a network, the user hears the alert message more accurately. Patients, physicians, and other healthcare professionals [2] will be easily incorporated into the Internet of Things in the future [3]. As wearable sensors, low- power Node MCUs, and wireless communication technologies advance, the Blind Person wireless body area network (BP- WBAN) is becoming a new research topic throughout the world [2]. WBANBs are represented by blind person body sensor networks (BP-BSNs) or body area networks (BANs), which have more possible and practical developments in light, compact, ultra-low power, and clever intelligent monitoring wearable sensors through unique advancements. IoT devices are the most economical and easy to use gadgets for everyone.

2. WIRELESS SENSOR NETWORKS

Wireless sensor networks (WSN)-based, an IoT is a hierarchical network in which a network element serves as an IoT item. The research community has focused heavily on IoT applications built on various WSN technologies. Smart grids, wireless personal area networks, and machine-tomachine communication will benefit from WSN integration with IoT. Because Internet of Things (IoT) devices and sensors are randomly distributed across the network, deterioration caused by the transmission of sensor node residual energy can have an impact on the network's stability and durability. WSNs for IoT applications have various hurdles in terms of service quality, device size, and cost. There are associated costs with nodes, equipment, communication channels, and other computing resources. [7] WSNs are large-scale networks that capture and transmit data over wireless communications channels and provide ubiquitous access via computer technologies. They allow individuals all over the world to connect to the Internet at any time and from any location. Furthermore, by integrating mobile transceivers into ordinary objects and technology, the world's things may be connected together. Sensors are used in IoT devices and objects to monitor certain events, and the acquired data is transferred through wired or wireless networks to servers or users, who extract and interpret the data and automatically operate and teach other equipment, [4] using self- configured and spatially dispersed small-sized devices outfitted with low-cost and low-powered sensors. Sensor nodes are built to function with limited resources like as energy, memory, compute, and transmission bandwidth. The WSN is composed of a number of sensing nodes that communicate with one another and are spatially spread in response to physical or environmental events. A processor and memory module, a transceiver module, and a power unit are the four primary components of typical wireless sensor nodes. Sensor nodes in anetwork may analyse data, collect data, and interact with othernodes [5]. WSNs will be important in future technologies. A WSN is a network of sensors that communicate and exchange data until they reach the gateway. Industrial control, sanitation, and environmental monitoring may all be aided by WSN. Sensors are becoming more affordable, which is propelling WSN technology and applications a head. Correlation of obtained data with location data is required for the production of data geographical and temporal maps. In large data creation, the usage of mobile WSN nodes with variable status is becoming more common. Many IoT-based solutions, such as property monitoring, wireless sensor networks, and intelligent medical devices, need reliable data and sector-specific functionality [6].

3. SMART STICK FOR BLIND

In this study, we discuss IoT-based smart solutions that areespecially beneficial for the blind since they are built with ultrasonic sensors and Node MCU boards. The Internet of Things technology can also help blind individuals distinguish items. According to the World Health Organization, 43 millionpeople will be blind and 295 million will have vision impairments by the year 2022. We utilized a buzzer in the experimental mode to detect any other object. The buzzer will glow, allowing a blind person to more easily identify the specific object. The distance detected from the object threshold value iseasily changed for the specific patient. This initiative serves asthe blind's third eye, allowing them to live in our world.

Ultrasonic Sensor

The ultrasonic sensor (US) is a common obstacle detectionsensor. The transmitter, which is connected to the sensor, produces the ultrasonic wave, which returns after hitting the obstacle and is received by the receiver, which is also connectedto the sensor. An ultrasonic sensor determines the distance between two objects by measuring the time between the emission and reception of ultrasonic waves by the transmitter and receiver. The formula below can be used to determine the distance. Distance (D) = 1/2 x, where D is the distance, T is the time between producing and receiving ultrasonic waves, and C is the sonic speed. A technique for computing the target's distance is provided to measure the distance between an object and a human. It is extremely advantageous to a blind person since it allows them to easily discern between items and move anywhere and everywhere without the assistance of another person.

TABLE I. ULTRASONIC SENSOR SPECIFICATIONS

HC-SR04	Specifications
Current Voltage (V)	DC 5 V
Ground Voltage (G)	0 V
Working Current (C)	15mA
Working Frequency (F)	40KHz
Range (Max/ Min)	400cm /2cm (Accurate to the nearest 0.3cm)
Angle of Measure	30 Degree
Trigger Signal	10uS TTL pulse
Echo Signal	Depend on max range of TTL
Dimensions	45*20*15mm

Buzzer

The device's buzzer is helpful when the visually impaired individual travels alone. The user has control over the performance threshold value. An ultrasonic sensor can be usedto detect objects. The time threshold value is controlled by the buzzer's sound, and it is decreased as it becomes illuminated. Two sound types are pre-programmed in a buzzer to play when the threshold value is reached. And it makes two beeping sounds. Once the value surpasses the threshold, a continuous beeping sound is produced by the device. The ability to easily exist in a certain environment may be of tremendous advantage to a visually impaired person.

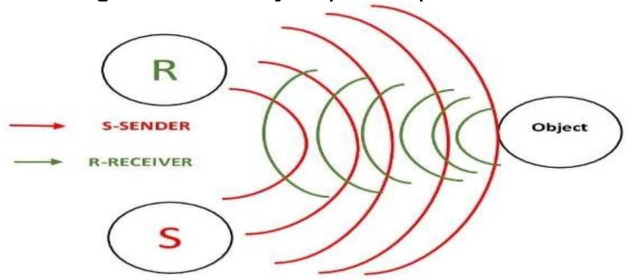

TABLE II. BUZZER SPECIFICATIONS

S.No	Parameter	Value	
		Minimum	Maximum
01	Rated Voltage	6V DC	
02	Rated Current (DC)	≤30mA	
03	Sound Output at 10cm(DC)	≥85dB	
04	Resonant Frequency	2300 ±300Hz	
05	Tone	Continuous	
06	Operating Voltage	4V DC	8V DC
07	Operating Temperature	-25°C	+80°C
08	Storage Temperature	-30°C	+85°C
09	Weight	2g	

4. SYMPTOMS

Smoking, Obesity, Depression, Hyper tension, High blood cholesterol, Poor diet, Family history and Physical inactivity

A. Types of Heart Disease

- *Coronary heart disease*
- *Angina pectoris*
- *Congestive heart failure*
- *Cardiomypathy*
- *Congenital heart disease*
- *Arrhythmias*
- *Myocarditis*
- *Heart attack*
- *Heart cancer etc.*

For detecting cardiovascular problems into the patients, the prediction methods like SVM, decision tree and neural networks are compared based on the metrics. It was found that in predicting cardio vascular disease the SVM performed better than other methods suggested by [73]. for forecasting the existence of heart disease, performance comparison was performed with Recursive Feature Elimination (RFE) feature selection with SVM classifier, Random Forest (RF) and Intensity Weighted Firefly Optimization (IWFFO).

5. LITERATURE REVIEW

Murthy & Meenakshi (2014) [36] proposed Neuro-genetic model development to predict coronary heart diseases. The new presented research task work was feature subset selectionby multi-objective genetic algorithm deprived of previous ANN accuracy on the basis of heart disease predictor. The intended designed Neuro-Genetic model pattern had been authenticated by means of 303 patient data sets attained for various age groups. The projected investigation had displayed prior heart disease detection with greater experimenting accuracy of 89.58% via reduced feature subset, hence minimizing the difficulty.

Alshurafa et al. (2014) [37] examined consequences from a Remote Health Monitoring (RHM) arranged in a six month Women's Heart Health research of 90 patients, and adopted superior feature selection and machine learning algorithms. This approach detects the patients' key baseline related features and constructed efficient prediction patterns to assist in determining RHM results success. Consequences from the Women's Heart Health research revealed this heart disease threat, life quality, family history, stress factors, social support, and anxiety at baseline each assisted to predict patient RHM result success.

Gao et al. (2015) [38] introduced two novel features to predict cardiac arrest that are Approximate Entropy (ApEn) and Sample Entropy (SpEn). The dimensionality reduction concept, PCA, was adopted to overwhelm the dimensionality. The results proved that this prediction performance of appending ApEn and SpEn to the 24 parameters was enhanced considerably when evaluated with just 24 parameters. Dimensionality reduction had more positive impacts on enhancing the prediction consequences.

Kaya & Pehlivan (2015) [39] discussed Premature Ventricular Contractions (PVCs) heartbeats classification from ECG signals and especially, on assessment performance of particular features by Genetic.

Boshra Bahrami et al. [40]. The author discovered many approach to diagnosis the heart disease .The various classifier techniques are the Decision Tree, Naive Bayes(NB),J48 K Nearest Neighbours (KNN) and SMO are used to classify dataset. The results are compared by the various Classification techniques by metrics such as the precision, specificity, area under ROC curve, accuracy, sensitivity3 and F-measure5. The results have been compared with the above algorithm and shows that J48 Decision tree is the best classifier
for diagnosing the heart disease on the existing dataset.

6. MACHINE LEARNING APPROACH

Machine learning is an interdisciplinary study, which has focused on algorithm design and computers utilize these algorithm for learning purpose. Learning is nothing but learning from the feature dataset. Generally, machine learning techniques are designed and implemented in such way that, they have permitted the expert system to produce the solution for the diagnostic problem by using previous information.

The different learning methods available for the classification task are supervised classification, unsupervised classification and reinforcement learning. The important application of machine learning is data mining. Classification is one of the supervised learning processes and the classification tool is used to predict the target class.

A. CLASSIFICATION

Classification is a common decision making job of human activities. Classification issues occur when objects are to be designated into pre-specified groups or classes on the basis of the quantity of noted features relating to that object. Several industrial issues are realized as classification issues. For instance, stock market predictions, weather forecasts, bankruptcy predictions, speech recognitions, character recognitions and so on and so forth. The classification issues may be resolved both in a mathematical as well as non-linear manner.

B. FEATURE SELECTION

One of the significant preprocessing options is feature selection, which is mainly used in data mining applications. In medical field, information are becoming very huge that increase the difficulty in decision making. This, decrease the performance of the prediction result in disease forecasting process.

Feature selection plays an important role in solving the scalability problems and improves the overall classification accuracy through removing the irrelevant features. It is the effective tool to choose the relevant feature from the medical dataset. Therefore, reducing unwanted features in the dataset is a significant process in data mining to achieve a better accuracy.

In this research, the dataset used for experimental setup was collected from UCI repository Cleveland database is selected for this research. 297 patients’ data is taken this research and 14 attributes also included. The proposed system is developed in Java language. The Net Beans IDE is utilized for front end design. MYSQL is used for database access.

Table 1 Feature information and class

Attribute	Type of Data	Description
Age	Numeric	age in years
Sex	Numeric	sex (1 = male; 0 = female)
Cp	Numeric	chest pain type -Value 1: typical angina Value 2: atypical angina -Value 3: non-anginal pain Value 4: asymptomatic
Trestbps	Numeric	resting blood pressure (in mm Hg on admission to the hospital)
Chol	Numeric	serum cholestoral in mg/dl
Fbs	Numeric	(fasting blood sugar > 120 mg/dl) (1 = true; 0 = false)
restecg	Numeric	resting electrocardiographic results
thalach	Numeric	maximum heart rate achieved
exang	Numeric	exercise induced angina (1 = yes; 0 = no)
oldpeak	Numeric	ST depression induced by exercise relative to rest
slope	Numeric	the slope of the peak exercise ST segment -Value 1: up sloping - Value 2: flat - Value 3: down sloping
ca	Numeric	number of major vessels (0-3) colored by fluoroscopy
thal	Numeric	3 = normal; 6 = fixed defect; 7 = reversable defect
num	Numeric	Diagnosis of heart disease (angiographic disease status) -- Value 0: < 50% diameter narrowing -- Value 1: > 50% diameter narrowing

7. RECURSIVE FEATURE ELIMINATION (RFE)

In RFE process, entire dataset is split into various slots, and necessary protein is calculated for the given slot. The values which are duplicate are pruned first using RFE. Originally 2 slots are taken by dumping from one slot to the other. If any of the slots has more elements or values, then both the slot is equalized. Equation is used to measure side by side, the average for a given feature. The value that is nearestfrom the first slot to the mean average is known as the criticalgene for that slot.

In the present heart disease prediction system, the RFE calculates the $\|w\|^2$ value to found the each attribute contributions. The w denotes the weight vector. The $\|w\|^2$ is considered as the ranking variable where the higher value of ‖w‖2 is considered as significant features by RFE.

‖w‖2 = |∑n α y ∅(x)|, j=1, 2...m

Where

∅($x$ij) - Occurrence of feature vector.

This feature selection method comes under backward procedure. This follows the iterative practice to remove the unwanted attributes in the dataset.

The working flow of the PFE is discussed below. Initially the model considered all the attributes/ features from the inputdataset. The ranking factor is computed for each attributes and selects the attributes with high rank which improves the performance of the model and the remaining attributes are considered as unwanted and removed. These processes are continuous to construct the final model that fit the final feature selection result. The procedure get closed when it reaches thestopping criterion

Support Vector Machines (SVM)

SVM are typically utilized in patterns recognition as wellas objects recognition originally, given sets of points that are part of one of two classes; linear SVMs discover hyperplanes leaving biggest possible fraction of points of the same classes on the same side, and performing maximization of distance of either class from hyperplanes SVMs as classification methods have yielded improved classification outcomes when compared with the other typically utilized pattern techniques like maximum likelihood and neural network classifiers. It is typically beneficial for classifying remotely sensed information.

SVM and other kernel methods were studied thus forming an optimized parameter bound by the number of training samples rather than the dimension of the feature space. Thus, kernel methods solve the dimensionality problem to a certain extent correlating with the samples; besides neuro imaging data put forth a high correlation between the feature needing a low dimensionality than the actual voxel and samples.

Moreover the advantages of feature selection outweigh the disadvantages.

The advantages are

a) It speeds up the testing process.
b) It makes interpretation easy.
c) It is simple to evaluate the results of smaller subsets sufficient to maintain classification accuracies.

8. PROPOSED METHODOLOGY

The proposed methodology for heart disease using Data Mining process is described with the architecture as shown inFigure 3.8. The first step is the selection of the best features isperformed by Intensity Weighted Firefly Optimization (IWFFO) Then the classification process is performed to predict Congestive Heart Failure.

A. Intensity Weighted Firefly Optimization (IWFFO)

Feature selection is process of selecting useful feature from dataset. Firefly is a kind of a flash light which tries to communicate with the other members of their nature. As the intensity of light vanishes with respect to distant locations, its accuracy can be defined at local horizons for finding the best solution for any function. The fireflies are the particles or the extracted features from peak estimations. Each extracted feature (firefly) is assigned by light intensity and out of all the extracted features the distinct features which have common species are selected as the best one. This is best explained by the contours in which random regions are created based on the nature of features extracted and the particles of similar species are attracted towards the centre of the regions of the contours.

The random regions are created based on the feature categories and the particles of similar nature will follow their own regions. Out of all the particles, some are in the centre of the regions and these are defined as the best features for better classification of disease. Hence fire fly optimization will serve the purpose of feature reduction technique by considering similar natured particles and neglecting the others. Let us consider TF as the feature vector or feature matrix. On selecting a training feature, T_r ' Define $\propto$, β *and* γ with some random values (here 0.2, I.0 and I.0 are considered respectively).

$$\text{Let } X = X_i \; (i = 1,2,3 \ldots\ldots\ldots n)$$

Where 'n' is the number of particles and 'X' is the population of fire flies.

$$\text{DefineI} = \text{rand}\,(T_F)$$

Where I denotes light intensity. Updating the observation coefficient as

$$\gamma_{i,j} = \sqrt{(x_i - x_j)^2 + (y_i - y_j)^2}$$

Where i= I,2,| 3, ... n, j=I,2, 3,................ m. Final updates are expressed as

$$x_n = x_n(i) * (1 - \beta) + x_n(j) * \beta + \alpha(\text{rand} - 0.5)$$

$$y_n = y_n(i) * (1 - \beta) + y_n(j) * \beta + \alpha(\text{rand} - 0.5)$$

When the light intensity gets updated after some iteration, the final values are indicated as

$f_t = I \quad (x, y) \longrightarrow$ Exact fitness value

$id = \min \quad (f_t) \longrightarrow$ Exact best fitness value

$T_r = T_F \quad (idx) \longrightarrow$ Selected best feature

9. RANDOM FORESTS

Classification is a common decision making job of human activities. Classification issues occur when objects are to be designated into pre-specified groups or classes on the basis of the quantity of noted features relating to that object. Several industrial issues are realized as classification issues. For instance, stock market predictions, weather forecasts, bankruptcy predictions, speech recognitions, character recognitions and so on and so forth. The classification issues may be resolved both in a mathematical as well as non-linear manner.

The Random Forest Tree (RFT) classifier is an ensemble classification approach and it is the type of the nearest neighbor classifier method. Breiman stated that, the RFT develops more number of trees based on the random selection of the variables. During the learning stage of the classifier, tree nodes are separated using a random subset of data features. The RFT classifier works based on bagging concept, in which each successive tree is generated independently using bootstrap sample of the data items and classification of data items is done, which is based on majority vote.

The drawback in traditional decision tree approach was overcomes in RF. The RF overcomes the problems faced in the prior decision tree approaches. In RF, the 10 fold cross validation is considered as the default value.

10. EXPERIMENTAL RESULT

The original Cleveland dataset with 303 instances is given as input to the SVM-RFE Algorithm. The results obtained have been tabulated in Figure 3.9. The dataset yields the improved weighted average values of Precision 90%, Recall 89%, F- measure 94% and achieved the highest accuracy of 94%.

TABLE II. TABLE EXPERIMENTAL RESULT OF PROPOSED METHOD RF-IWFFO

Algorithm	Precision (%)	Recall (%)	F-Measure (%)	Accuracy (%)
SVM-RFE	90.3%	89.4%	94.5%	94.5%
RF-IWFFO	93.2%	90.1%	98.7%	98.7%

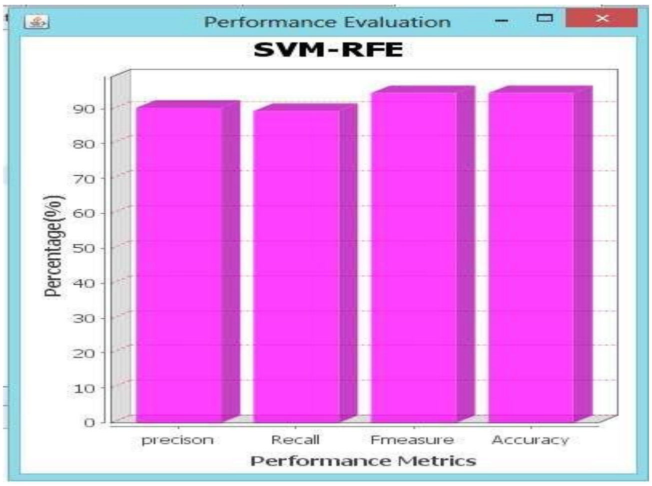

Fig. 1 Classification Algorithm of SVM-RFE

The original Cleveland dataset with 303 instances is given as input to the RF-IWFFO Algorithm. The results obtained have been tabulated in Figure 3.10. The dataset yields the improved weighted average values of Precision 93%, Recall 90%, F-measure 98% and achieved the highest accuracy of 98%. Compared to SVM-RFE classifier, RF-IWFFO classifier obtains the highest accuracy of 98.7% in heart disease prediction.

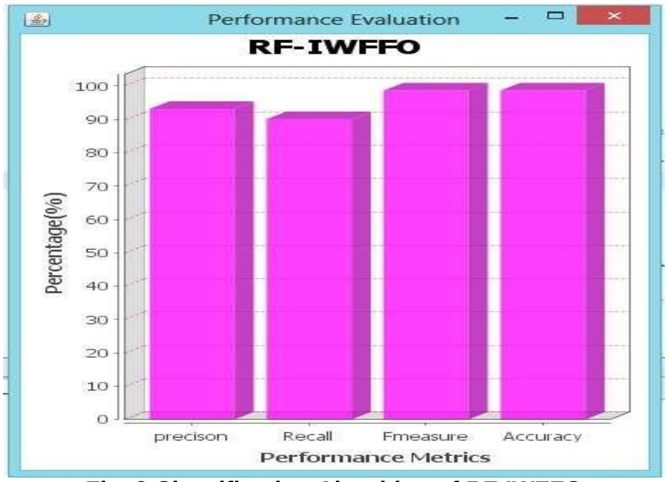

Fig. 2.Classification Algorithm of RF-IWFFO

11. CONCLUSION

The recommended solution can provide a simple way for effective health monitoring and smart sticks by employing smart healthcare systems and smart sticks for visually impaired people. It is quite convenient to maintain via a website, and it allows physicians to perform very simple analyses. This WBANB is extremely beneficial to vision challenged elderly patients. They use smart sticks to detect items and easily monitor their bodies with the use of healthcare IoT nodes.

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