International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-10 Issue-5, March 2021

Analysis on E-Healthcare Monitoring System with Iot and Big Patient Data

V. Deepa, K. Rajeswari

Abstract:---Internet of Things (IoT) technology helped the development of healthcare from face-to-face consulting to the telemedicine. Smart healthcare system in IoT environment monitored the patient basic health signs such as heart rate, body temperature, and hospital room condition in real-time applications. The IoT and big data is an important challenge in many fields including smart healthcare systems due to its significance. Big data is employed to analyse the huge volume of data. Big data are significantly used in healthcare technique to determine the normal and abnormal patient condition. The doctors are easily analysed the patient condition in a short time. This system is very easy to design and use. It is employed to enhance the present healthcare system which preserves the lot of lives from death. Healthcare monitoring system in hospitals has experienced large development and portable healthcare monitoring systems with new technologies. Connected healthcare is an essential solution for hospital to record and analyse the patient data and to save money. The clustering and classification methods are used in existing methods. The clustering method is employed to group the similar data. The classification method is utilized to classify the patient data. A lot of healthcare technique was introduced by many researchers ranging from diagnosis to treatment and prevention on efficient e-health monitoring system. But, the accuracy level was not improved and time consumption was not reduced by existing techniques. In order to address these problems, different methods and techniques were reviewed for performing the e-healthcare monitoring system with big data. The machine learning techniques are used for efficient diseased patient health monitoring through the effective performance of feature selection, clustering and patient classification with increase the accuracy and minimum time consumption. The results are is performed using on different factors such as clustering accuracy, clustering time, classification accuracy, classification time, and error rate with respect to number of patient data.

Keywords: Internet of Things, telemedicine, e-health monitoring system, prevention, patient data

I. INTRODUCTION

Big data is a large volume of structured and unstructured data. Internet of Things (IoT) is a new environment where every connected node communicates with the additional nodes inside the network to transfer essential data for accurate and real-time decision making. IoT is a very efficient environment in critical situations like medical purposes. Internet has become the essential part of daily life. Internet of things (IoT) formed interconnected network for all things recognized as new technology. Healthcare sector has improved their performance with help of new technology.

Health issues like cardiovascular failure, lung failure and cardiovascular diseases are increasing gradually. The problems need the health monitoring system from time to time. A doctor monitored the patient health without any direct interact. Health specialists developed healthcare monitoring system for many diseases with help of technologies like wearable devices, wireless channels and additional remote instruments.

This paper is categorized as follows: Section 2 studies the review on different e- healthcare monitoring system, Section 3 reveals the study and analysis of the three existing e-healthcare monitoring system, Section 4 explains the possible comparison of existing e-healthcare monitoring system. In section 5, the discussion and limitations of the existing e-healthcare monitoring system are studied with future direction and Section 6 concludes the paper.

II. LITERATURE REVIEW

Energy Efficient Particle Swarm Optimization (PSO) based Clustering (EEPSOC) method was designed in [1] for effective cluster head (CH) selection among diverse IoT devices. An artificial neural network (ANN) based classification model diagnose the healthcare data to identify the disease severity in cloud server. Though energy consumption was minimized, time complexity was not minimized through EEPSOC method. An IoT-based student healthcare monitoring model was designed in [2] to verify student vital symptoms and identify behavioural variations through smart healthcare technologies. However, the accuracy level was not improved through IoT-based student healthcare monitoring model.

An efficient sensor-based data analytics was introduced in [3] for real-time patient monitoring to assist the hospital and medical staff. However, the sensor nodes failed to avoid the repeated collision. The designed mechanism failed to control the sensing frequency depending on available energy at different periods. PATH2iot framework was introduced in [4] to divide the IoT application into micro-operation. PATH2iot employed the heuristic model for taking optimal deployment decision depending on the multiple non-functional requirements and selection criterion. However, energy consumption was not reduced for data communication through PATH2iot framework.

A low-cost and accessible Internet of Things (IoT) methodology was designed in [5] with biomedical information possibilities.

Manuscript received on March 20, 2021.
Revised Manuscript received on March 30, 2021.
Manuscript published on March 30, 2021.
* Correspondence Author
V. Deepa*, Ph.D Research Scholar, Tiruppur Kumaran College for Women, PG and Research Department of Computer Science, Tiruppur.
Dr. K. Rajeswari, Associate Professor, PG and Research Department of Computer Science, Tirppur Kumaran College for women, Tiruppur.

Though computational cost was reduced, designed technology failed to improve the current workflow within gait analysis. A smart healthcare system was introduced in [6] for IoT environment to monitor patient healthcare sign and room condition in real-time. However, the video feature was not included for face to face consultation between the doctors and patients.

A comprehensive conceptual framework was designed in [7] for energy harvesting in the health monitoring sensors. The data processing and decision management was used for healthcare applications. But, the computational cost was not reduced by designed architecture. A new architecture was designed in [8] for health status prediction and analytics system with big data technologies. The designed architecture was employed to perform the data streaming from distributed sources to forecast the health status. But, the real data sources were not combined with system for performing the user request interaction.

A holistic Deep Neural Network-driven IoT smart healthcare technique termed Grey Filter Bayesian Convolution Neural Network (GFB-CNN) was introduced in [9] depending on real-time analytics. Though designed accuracy was improved, the disease diagnosis time consumption was not minimized. Virtual patients monitoring was carried out in [10] through wearable sensor nodes to avail the expert services with medical facility. Android based heaLth Enabled Remote Terminal (ALERT) system was introduced to record data and transmitted to the cloud. but, the designed healthcare system failed to improve the performance of medical healthcare to predict the patient disease at early stage.

Deep Learning-based Internet of Health Framework termed DeTrAs was introduced in [11] for Patient monitoring. An ensemble approach was designed for abnormality Alzheimer patient tracking through combining the convolutional neural network emotion detection scheme and timestamp window natural language processing scheme. But, the designed approach failed to enhance the diagnosis performance by ambient intelligence and game theoretic approach. A PPG quality assessment approach was designed in [12] for IoT-based health monitoring systems. An unreliable data get removed to eliminate the inexact decision making and false alarm. However, the computational complexity level was not minimized by ALERT system.

III. E-HEALTHCARE MONITORING SYSTEM WITH IoT AND BIGDATA

Internet is used in different fields like education, finance, business, healthcare, industries, social networking, shopping, E-commerce. Health is an essential global demand for humanity. With the World Health Organization (WHO), highest attainable standard of health is an essential right for individual. Healthy individual reduced pressure on overwhelmed hospitals, clinics and medical professionals and reduce workload on the public safety networks, charities, and governmental organizations. A modernized healthcare system present improved healthcare services to the people at anytime and anywhere. Healthcare Monitoring System (HMS) is employed to arrange day-to-day process with the systems activities such as clinical, administration and commercial perspectives. HMS is constructed on sub-systems to obtain tolerable care for patient and clinical management. The information is gathered from different sources such as patient health data, hospital administrative data and external data.

A. Energy Efficient Clustering with Disease Diagnosis Model for IoT based Sustainable Healthcare Systems

Energy Efficient Particle Swarm Optimization (PSO) based Clustering (EEPSOC) technique was introduced for performing the cluster head (CH) selection among different IoT devices. IoT devices were employed for sensing the healthcare data formed into clusters. CH was selected by EEPSOC. The chosen CH transmitted the data to cloud server. The CH was responsible for sending data of IoT devices to the cloud server through fog devices. An artificial neural network (ANN) based classification model was introduced to diagnose the healthcare data in cloud server to recognize the disease severity. EEPSOC technique functioned on three subsystems, namely user subsystem, cloud subsystem and alert subset. The initial user subsystem performed the data acquisition with IoT medical devices from user. EEPSOC technique was introduced to group the IoT devices and to choose the cluster head properly. CH transmitted the sensed data from IoT devices to gateway devices and cloud subsystem. In cloud subsystem, disease diagnosis process was carried out with ANN to forecast the disease with diverse severity levels and generate the alert system.

PSO was considered as the population-centric optimizing model. The arbitrary solution of system was started for searching the optimized solution in all generation. The solution attained in all generation was considered as particles. Fitness function (FF) of every particle employed to find the optimal solution. FF of new best particle was considered as the best. PSO was employed to attain better population measure by different particle from neighbours. ANN technique is soft computing model developed by biological nervous systems like human brain. In weighted directed graphs, nodes were considered as artificial neurons and directed edges among neurons. It was categorized into two classes, namely Feedforward and Recurrent networks. Feedforward networks were considered as static and recurrent networks were considered as dynamic. The Feed forward networks were limited with lesser storage. Depending on feedback paths, inputs for all neurons were changed and it allowed the system to enter into the novel state. When the data was provided at input layer, network neurons carried out the estimations at subsequent layers for neurons. The neurons in input and hidden layers were connected with one another of next layer through weight values.

B. A new machine learning-based healthcare monitoring model for student's condition diagnosis in Internet of Things environment

An IoT-based student healthcare monitoring model was introduced to verify the student vital signs and to recognize the biological as well as behavioural variations through smart healthcare technologies.

In designed model, the data were gathered through IoT devices and data analysis was performed by machine learning techniques for identifying the probable risks of student physiological and behavioural changes. The designed model improved the efficiency and accuracy for identifying the student condition. The designed model was used from three layers, namely IoT layer, cloud layer, and student health monitoring layer. In first phase, the patient data were obtained through medical devices and sensors. The devices transmitted data to cloud subsystem through input path. In second phase, data mining techniques are used with patient data for taking the decisions regarding the student health. In third phase, parents were used with the information and warning about student health when required In addition, an alert was given to the hospital when emergency situation occur to call medical emergency services to patient location. Random forest (RF) was machine learning algorithm to attain the improved results without changing parameters. Due to simplicity and usability, machine learning algorithm was employed for classification and regression. The data were collected to refine the estimate and decision. The designed algorithm used best features among the random set of features. In RF, features subset algorithm was employed to partition the node. Therefore, the algorithmic process of an IoT-based student healthcare monitoring model is described as follows.

IoT layer:
Step 1: Install mobile application on student's parent's device.
Step 2: Enter student's health data
Step 3: Automatically assign a registration number for each student
Step 4: Place ECG / EEG and blood pressure biosensors inside the subject's body or on the subject's body surface or wearable devices in the school
Step 5: Gather physiological data in structured and unstructured ways
Step 6: Synchronize as LPU unit or it's gateway that can be a portable device or a smartphone
Step 7: Send the gathered information to service repository using 5G / 4G / GPRS mobile networks
Step 8: Using security measurements such as third-party encryption, user authentication and credential mapping
Student Health Monitoring Layer:
Step 1: If (Student's health status == Not Sensitive)
Step 2: Inform the physician about student's health status
Step 3: Else if (student's health status == Sensitive)
Step 4: Send an alert to the closest medical center about student's health status
Step 5: Else
Step 6: Insert information to student's health record
Cloud Layer:
Step 1: Store retrieved data from service repository on a cloud storage which is the IaaS service Provider
Step 2: Transmit data from data center into the cloud storage repository for effective cognitive decision making
Step 3: Apply the normalization to set the data into 0 to 1 range
Step 4: Perform classification algorithm, SVM, to assess student's heath status
Step 5: Last layer of the system is dedicated to archive student's health data and taking the necessary measures to enhance student's health status or saving data in the cloud storage

Algorithm 4.1 Algorithmic process of an IoT-based student healthcare monitoring model

C. A Sensor-Based Data Analytics for Patient Monitoring in Connected Healthcare Applications

An efficient sensor-based data analytics model was employed for real-time patient monitoring and assessment to the hospital and medical staff. The designed model comprised three phases, namely emergency detection, sensing frequency adaption and real time prediction of patient situation. The designed model employed the data analytics methods for prediction and reduction. The patient monitoring after critical situation comprised major tasks of medical staff in critical situation resulting in death. An emergency detection algorithm was introduced with biosensor to update the medical staff regarding any abnormal situation. The periodic patient monitoring model and Early Warning Score (EWS) guide were employed to validate the abnormal situation. LSTM method was employed to restore the raw data gathered by sensors. The threshold values and processing complexity of LSTM were determined by decision makers depending on the monitored features. The processing complexity of LSTM was reduced based on desired accuracy level to predict the patient situation progress.

IV. PERFORMANCE ANALYSIS E-HEALTHCARE MONITORING SYSTEM WITH IOT AND BIGDATA

In order to evaluate the different e-healthcare monitoring system, number of patient data points is taken as an input to perform the experiment. Different parameters are discussed for increasing the e-healthcare monitoring system performance. For experimental evaluation, Cardiovascular Disease Dataset is considered as an input. The URL of the mentioned dataset is given as https://www.kaggle.com/sulianova/cardiovascular-disease-dataset. The dataset comprises 13 features and 70000 records. The dataset includes the cardio_train.csv. The patient information has factual information with result of medical information. Result analysis are evaluated with certain parameters like,

- ✓ Accuracy
- ✓ Time complexity and
- ✓ Error rate

A. Impact on Accuracy

Accuracy is described as the ratio of number of patient data that are correctly classified the patient health condition to the total number of patient data considered as input. Therefore, the accuracy is determined as,

$$Accuracy = \frac{Number\ of\ patient\ data\ that\ are\ correctly\ classified}{Total\ number\ of\ patient\ data} * 100 \quad (1)$$

From (1), the accuracy is calculated. When the accuracy value is higher, the method is said to be more efficient.

Table 1 Tabulation of Accuracy Level

Number of Patient Data	Accuracy Level (%)		
	EEPSOC technique	IoT-based student healthcare monitoring model	Efficient sensor-based data analytics model
100	85	72	78
200	87	75	81
300	89	76	83
400	88	74	82
500	86	73	80
600	89	75	81
700	90	77	84
800	92	79	86
900	93	80	88
1000	95	82	90

Table 1 explains the accuracy with respect to number of patient data ranging from 100 to 1000. Prediction accuracy comparison is carried out on existing Energy Efficient Particle Swarm Optimization (PSO) based Clustering (EEPSOC) technique, IoT-based student healthcare monitoring model and efficient sensor-based data analytics model. From above mentioned table value, it is clear that the accuracy of EEPSOC technique is higher when compared to IoT-based student healthcare monitoring model and efficient sensor based data analytics model. The graphical representation of accuracy is illustrated in figure 1.

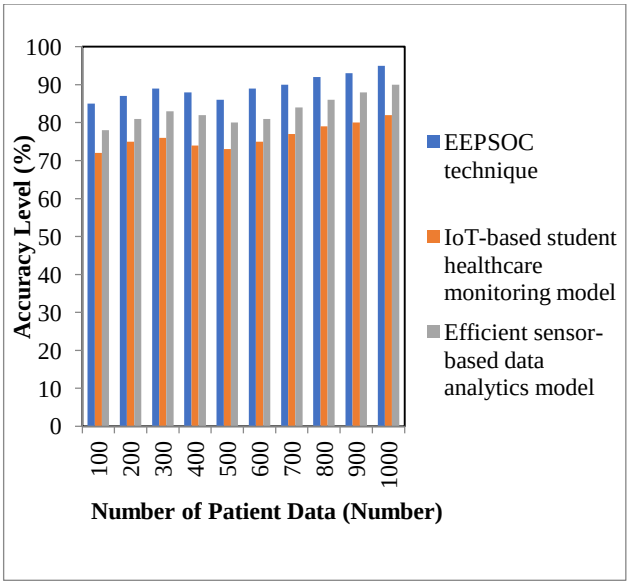

Figure 1 Measurement of Accuracy Level

As described in the figure 1, the accuracy level is determined for different number of patient data. It is observed that the accuracy level of EEPSOC technique gets increased than other existing methods. This is due to the application of PSO to achieve better population measure through different particle from neighbours. EEPSOC technique was grouped the IoT devices and selected the cluster head properly. An artificial neural network (ANN) based classification model to diagnose the healthcare data in cloud server to recognize the disease severity. This in turn helps to improve the accuracy level during e-healthcare monitoring system. As a result, the accuracy level of EEPSOC technique is increased by 17% when compared to the IoT-based student healthcare monitoring model and 7% when compared to efficient sensor-based data analytics model.

B. Impact on Time Complexity

Time Complexity is defined as the amount of time required to perform the patient data classification for efficient patient healthcare monitoring system. It is described as the difference of starting time and ending time of patient data classification in healthcare monitoring system. Consequently, it is formulated as,

$$Time\ complexity = Ending\ time - starting\ time\ of\ patient\ data\ classification \quad (2)$$

From (2), the time complexity (TC) is determined. When the time complexity is lesser, the method is said to be more efficient.

Table 2 Tabulation of Time Complexity

Number of Patient Data	Time Complexity (ms)		
	EEPSOC technique	IoT-based student healthcare monitoring model	Efficient sensor-based data analytics model
100	19	15	22
200	21	17	24
300	23	20	26
400	26	22	29
500	29	25	33
600	31	27	36
700	35	28	39
800	39	30	43
900	41	32	46
1000	43	35	49

Table 2 describes the time complexity with respect to different number of patient data ranging from 100 to 1000. Time complexity comparison is performed on Energy Efficient Particle Swarm Optimization (PSO) based Clustering (EEPSOC) technique, IoT-based student healthcare monitoring model and efficient sensor-based data analytics model. From the table value, it is clear that the time complexity of IoT-based student healthcare monitoring model is lesser when compared to the EEPSOC technique and efficient sensor-based data analytics model. The graphical representation of time complexity is illustrated in figure 2.

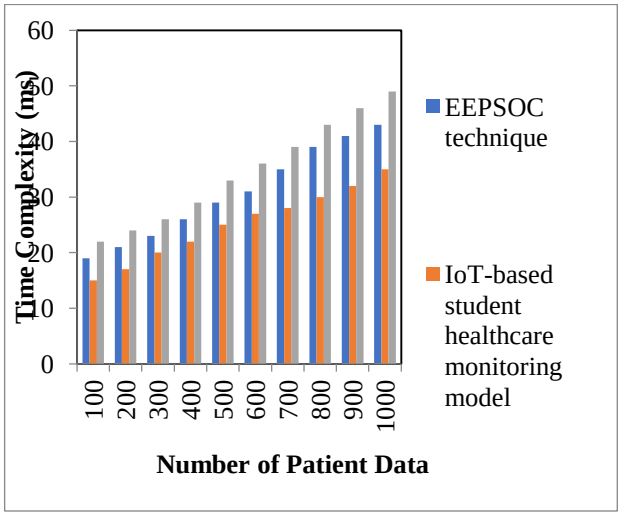

Figure 2 Measurement of Time Complexity

From figure 2, the time complexity is computed for different number of patient data. It is seen that the time complexity of IoT-based student healthcare monitoring model gets minimized than other existing methods. This is due to the application of random forest (RF) classifier to achieve enhanced results without varying the parameters. Due to the simplicity, machine learning algorithm was used for categorization and regression. The data were gathered to take necessary decision. In RF, features subset algorithm was used to partition the node for performing the data classification. As a result, the time complexity of IoT-based student healthcare monitoring model is reduced by 18% when compared to the EEPSOC technique and 27% when compared to efficient sensor-based data analytics model.

C. Impact on Error Rate

Error rate is defined as ratio of number of patient data that are incorrectly classified the patient health condition to the total number of patient data taken as the input. Thus, the error rate is computed as,

$$Error\ rate = \frac{Number\ of\ patient\ data\ that\ are\ incorrectly\ classified}{Total\ number\ of\ patient\ data} * 100 \quad (3)$$

From the equation (3), the error rate is determined. When the error rate is lesser, the method is said to be more efficient.

Table 3 Tabulation of Error Rate

Number of Patient Data	Error rate (%)		
	EEPSOC technique	IoT-based student healthcare monitoring model	Efficient sensor-based data analytics model
100	20	18	12
200	23	20	14
300	26	23	16
400	24	21	12
500	22	19	10
600	20	17	8
700	23	20	11
800	26	22	13
900	29	25	15
1000	32	28	17

Table 3 explains the error rate comparison for different number of patient data ranging from 100 to 1000. Error rate comparison is carried out with three existing methods. From the table value, it is clear that the error rate of efficient sensor-based data analytics model is lesser when compared to the EEPSOC technique and IoT-based student healthcare monitoring model. The graphical representation of error rate is illustrated in figure 3.

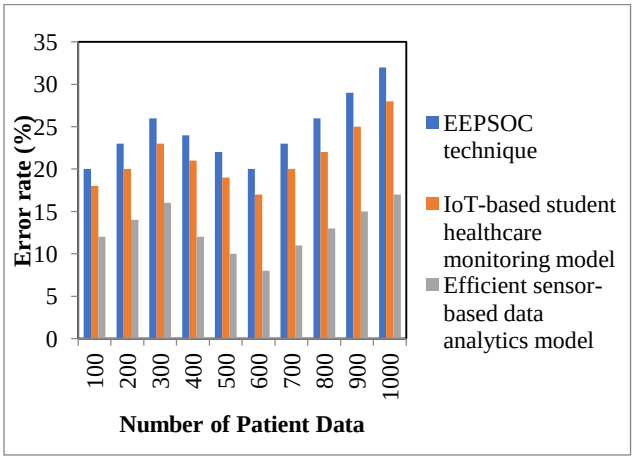

Figure 3 Measurement of Error Rate

From figure 3, the error rate is determined for diverse number of patient data. It is seen that the error rate of an efficient sensor-based data analytics model gets reduced than other existing methods. This is because of applying periodic patient monitoring model and Early Warning Score (EWS) guide to authorize the abnormal situation. LSTM method restored the raw data collected by sensors. The threshold values and processing complexity were calculated through decision makers with help of the monitored features. Accordingly, the error rate of efficient sensor-based data analytics model gets minimized by 48% when compared to the EEPSOC technique and by 40% when compared to IoT-based student healthcare monitoring model.

Table 4 Comparison results of E-Healthcare Monitoring Techniques

E-Healthcare Monitoring Techniques	Accuracy	Time Complexity	Error rate
EEPSOC technique	89%	31%	25%
IoT-based student healthcare monitoring model	76%	25%	21%
Efficient sensor-based data analytics model	83%	34%	13%

V. DISCUSSION AND LIMITATIONS ON DIFFERENT E-HEALTHCARE MONITORING TECHNIQUES

An IoT-based student healthcare monitoring model checked the student signs and identified the biological and behavioural changes through smart healthcare technologies. The designed model enhanced the accuracy for identifying the student condition. SVM algorithm performed the student health function status classification to attain the optimal prediction. The accuracy level was not reduced through IoT-based student healthcare monitoring model.

EEPSOC method was designed for efficient cluster heads (CH) selection among different IoT devices. ANN based classification model diagnosed the healthcare data in cloud server to identify the disease severity level. CH was accountable for transmitting the data of IoT devices to the cloud server through fog devices. Energy consumption gets minimized by EEPSOC method. Though the energy consumption was minimized, the time complexity was not reduced using EEPSOC method.

An efficient sensor-based data analytics model performed patient monitoring and evaluation to help the hospital and medical staff. The designed mechanism reduced the energy consumption of every biosensor and data redundancy. But, the sensor nodes failed to avoid the repeated collision. The designed mechanism failed to adjust sensing frequency depending on available energy beside redundancies between readings at the different periods.

A. Future Direction

The future work of e-healthcare monitoring system can be carried out using machine learning and deep learning techniques with higher accuracy and lesser time consumption.

VI. CONCLUSION

A comparison of different existing e-healthcare monitoring system is studied for improving the accuracy level in IoT and big data. In this environment, clustering and classification process are used in the e-healthcare monitoring system. This paper also discussed the methodologies and different methods to monitor the patient health condition in efficient manner. The performance analysis is carried out for factors such as accuracy, time complexity and error rate with respect to number of patient data. The EEPSOC technique is used to improve the accuracy level with aid of PSO.An IoT-based student healthcare monitoring model is employed for minimizing the time complexity by using random forest (RF) classifier. An efficient sensor-based data analytics model is utilized to reduce the error rate by applying the periodic patient monitoring model and Early Warning Score (EWS) guide. From the analysis, it is clear that the sensor nodes failed to avoid the repeated collision. The survival review illustrates that the time complexity was not reduced using EEPSOC method. In addition, the accuracy level was not reduced through IoT-based student healthcare monitoring model. The wide range of experiments on existing e-healthcare monitoring system is considered with its limitations. Finally, from the result, the research work can be carried out using machine learning and deep learning techniques for enhancing the results of e-healthcare monitoring system with higher accuracy and lesser time consumption.

REFERENCES

1. R. Bharathi, T. Abirami, S. Dhanasekaran, Deepak Gupta, Ashish Khanna, Mohamed Elhoseny K. Shankar, “Energy Efficient Clustering with Disease Diagnosis Model for IoT based Sustainable Healthcare Systems”, Sustainable Computing: Informatics and Systems, Volume 28, December 2020, Pages 1-28
2. Alireza Souri, Marwan Yassin Ghafour, Aram Mahmood Ahmed, Fatemeh Safara, Ali Yamini and Mahdi Hoseyninezhad, “A new machine learning-based healthcare monitoring model for student’s condition diagnosis in Internet of Things environment”, Soft Computing, Springer, Volume 24, 2020, Pages 17111–17121
3. Hassan Harb, Ali Mansour, Abbass Nasser, Eduardo Motta Cruz and Isabel de la Torre Diez, “Sensor-Based Data Analytics for Patient Monitoring in Connected Healthcare Applications”, IEEE Sensors Journal, Volume 21, Issue 2, January 2021, Pages 1-10
4. Devki Nandan Jha, Peter Michalak, Zhenyu Wen, Rajiv Ranjan, and Paul Watson “Multi-objective Deployment of Data Analysis Operations in Heterogeneous IoT Infrastructure”, IEEE Transactions on Industrial Informatics, Volume 16, Issue 11, November 2020, Pages 7014 - 7024
5. G. Coulby, A. Clear, O. Jones, F. Young, S. Stuart and A. Godfrey, “Towards remote healthcare monitoring using accessible IoT technology: state-of-the-art, insights and experimental design”, BioMedical Engineering OnLine, Springer, Volume 19, Issue 80, 2020, Pages 1-24
6. Md. Milon Islam, Ashikur Rahaman and Md. Rashedul Islam, “Development of Smart Healthcare Monitoring System in IoT Environment”, SN Computer Science, Springer, Volume 1, Issue 185, 2020, Pages 1-11
7. Muhammad Babar, Ataur Rahman, Fahim Arif and Gwanggil Jeon, “Energy-harvesting based on internet of things and big data analytics for smart health monitoring”, Sustainable Computing: Informatics and Systems, Elsevier, Volume 20, December 2018, Pages 155-164
8. Abderrahmane Ed-daoudy and Khalil Maalmi, “A new Internet of Things architecture for real-time prediction of various diseases using machine learning on big data environment”, Journal of Big Data, Springer, Volume 6, Issue 104, 2019, Pages 1-25
9. Rizwan Patan, G S Pradeep Ghantasala, Ramesh Sekaran, Deepak Gupta and Manikandan Ramachandran, “Smart healthcare and quality of service in IoT using grey filter convolutional based cyber physical system”, Sustainable Cities and Society, Elsevier, Volume 59, 2020, Pages 1-15
10. Suneeta S. Raykar and Vinayak N. Shet, “Design of healthcare system using IoT enabled application”, Materials Today: Proceedings, Elsevier, Volume 23, 2020, Pages 62-67
11. Sumit Sharma, Rajan Kumar Dudeja, Gagangeet Singh Aujla, Rasmeet Singh Bali and Neeraj Kumar, “DeTrAs: deep learning-based healthcare framework for IoT-based assistance of Alzheimer patients”, Neural Computing and Applications, Springer, 2020, Pages 1-13
12. Emad Kasaeyan Naeini, Iman Azimi, Amir M. Rahmania, Pasi Liljeberg and Nikil Dutt., “A Real-time PPG Quality Assessment Approach for Healthcare Internet-of-Things”, Procedia Computer Science, Elsevier, Volume 151, 2019, Pages 551-558

AUTHOR’S PROFILE

I am **V. Deepa,** M.phil, and doing my Ph.D Research Tiruppur Kumaran College for Women, PG and Research Department of Computer science, Tiruppur. Interested areas of research are Data Mining, Image Processing and Big Data

I am **Dr. K.Rajeswari,** M.sc, M.phil, Associate Professor, PG and Research Department of Computer science, Tirppur Kumaran College for women, Tiruppur. I am having more than 21years of teaching experience and published more than 45 papers .I am also Interested Research areas are Data Mining, Image Processing,Networking ,,Big Data.