Quest Journals
Journal of Software Engineering and Simulation
Volume 9 ~ Issue 4 (2023) pp: 92-98
ISSN(Online) :2321-3795 ISSN (Print):2321-3809
www.questjournals.org

Research Paper

A Review: Wireless sensor networks using machine learning and cloud computing

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Abstract — *Cheap air pollution in highly distributed networks, wireless sensors are more prevalent and offer superior spatial resolution for monitoring ambient air quality. For applications in smart cities in comparison to unsupervised learning and reinforcement learning supervised learning algorithms have been utilized more frequently. Utilizing machine learning algorithms and WSN cloud computing nodes, smart city applications can be used as an optimization tool. Agriculture-related wireless sensor network (WSN) applications are covered in the most recent academic literature. The main conclusions from the extensive analysis and clustering based on term co-occurrence indicate that WSN is a crucial tool for precision farming. To maintain track of enemy missile and aircraft attacks, it is essential to construct a battlefield surveillance system that consists of multiple sensors and mobile equipment. Utilizing the capabilities of current cloud computing platforms, WSN management runs an algorithm for reinforcement learning that bases judgements on evolution of the surrounding environment. completely distributed fault detection with a wireless sensor network. Wireless sensor networks (WSNs) enable both the environment and people to contribute stimuli.*
Keywords— wireless sensor network, cloud computing, reinforcement learning, unsupervised learning agriculture, Mobile wireless sensor network (MWSN), Fault detection.

*Received 09 Apr., 2023; Revised 21 Apr., 2023; Accepted 23 Apr., 2023 © The author(s) 2023. Published with open access at **www.questjournals.org***

I. INTRODUCTION

Natural and human emissions (from industry and transportation) are the main contributors to air pollution. Among the most dangerous contaminants are volatile organic compounds. (VOCs). They easily vaporize in the atmosphere due to their high vapor pressure under ordinary conditions. For monitoring and control purposes in smart cities Wireless sensor networks with low power requirements and data regulations. The IoT uses the WSN nodes as the foundational technical architecture. the internet-connected miniature physical sensors implanted in small gadgets to carry out a particular application are referred to as "things" in the Internet of Things. As the next generation of completely automated IOT apps, artificial intelligence (AI) and machine learning (ML) is emerging as a new breakthrough technology WSN is made up of several intelligent, wirelessly connected nodes that run on batteries. These nodes are now more energy-efficient and less expensive.

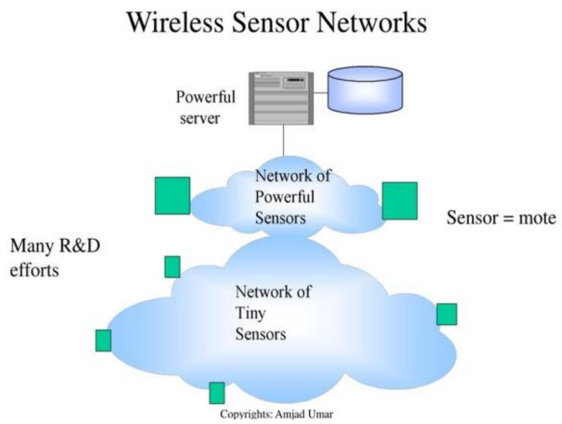

Fig. 1 (a): Wireless Sensor Networks

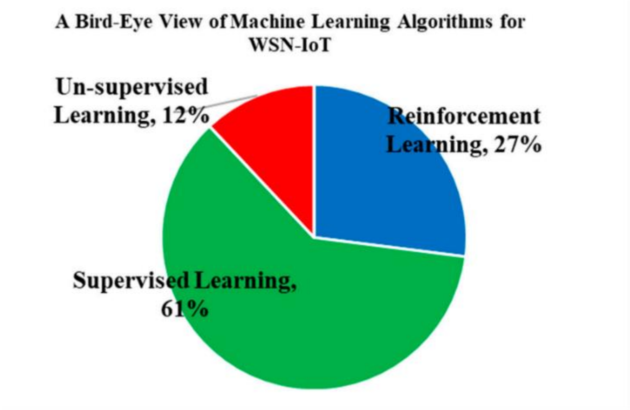

Fig. 1 (b): View of Machine Learning algorithm for WSN

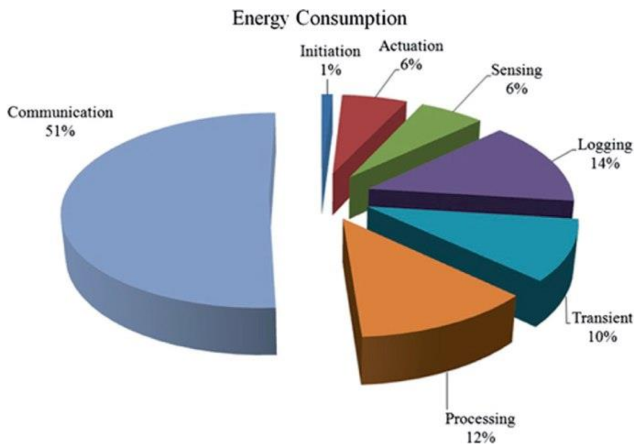

Fig. 1 (c): A comparison of wireless sensor network energy consumption

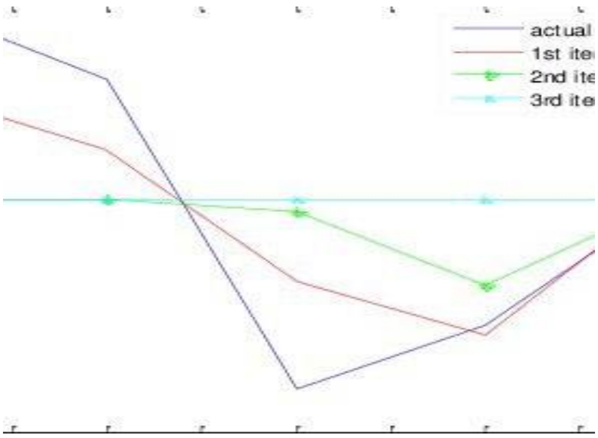

Fig. 2 (a): Load balancing graph rate

Applications for smart cities that use WSN nodes include intelligent traffic monitoring, intelligent building grids, and intelligent remote monitoring of healthcare, intelligent agricultural, and intelligent industrial applications. Another example shows how WSN can be used to measure temperature and soil properties, monitor fields, and optimize irrigation. The integration of various cloud-based battlefield surveillance technologies is the first issue.

Huge numbers of wireless devices that are small, low power, and frequently sent to inconvenient locations make up WSNs. In this area, in order to mitigate various problems, wireless sensor networks are essential of many issues with conventional monitoring systems. In order to achieve they offer a continuous and distributed operation, allowing for the necessary increase in the spatial density of the measurements., which is crucial in this field. An example of the use of WSN for field monitoring, irrigation optimization, temperature measurement, and soil property measurement.

A WSN is made up of numerous micro-integrated sensor nodes that collaborate to monitor, perceive, and gather data about their surroundings. One of the WSN's core technologies, multi-hop routing, is mostly responsible for transferring data collected by sensor nodes from the source node to the final node in accordance with the designated routing protocol.

Literature Work

Figure 3 depicts the progression of our study into a wireless sensor networks using machine learning and cloud computing We gathered 40 research articles from well-known websites like Springer, Hindawi, IEEE Xplore, Science Direct, and Tech Science. We carefully read through each paper's abstract to gain the knowledge we needed, identify the concept and purpose of those papers, and then studied the various problems and looked for best techniques and algorithms to analyze them.

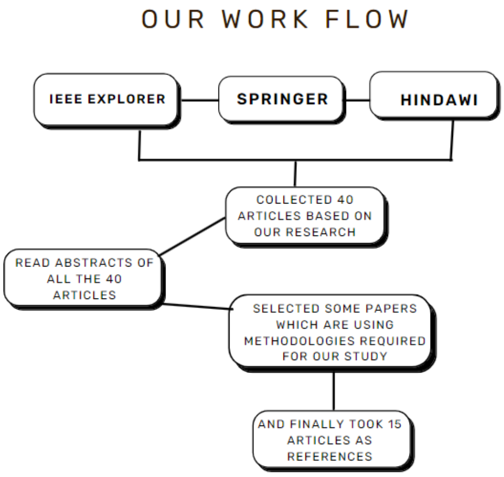

Fig. 3(a): work flow behind this paper.

[Patricia Arroyo, et. At. 2019]:- Today, air pollution is being monitored by wireless sensors that are dispersed in across networks and can provide higher spatial resolution than most conventional systems. Sensor nodes deliver field measurement data to the cloud using ZigBee motes' low power. By utilising artificial intelligence techniques, On the cloud, data processing and analysis are done. To maximise the detection of chemicals and contaminants. The network's goal is to find air contaminants over broad areas. Another ongoing project that will provide a crucial real-time data about people's health is connection between air quality and gas detection.

[Alireza Abdollahi, et. At. 2021]: - In the most recent academic research, wireless sensor networks (WSNs) have applications in agriculture. In the relevant literature was divided and the keyword of cooccurrence network was created using the computer programming system VOS viewer. Another area of WSN research focuses on how other technologies, such as the Internet of Things (IoT), cloud computing, artificial intelligence, and unmanned aerial vehicles, can help with a range of agricultural tasks, like smart irrigation and soil management. The fusion of various technologies and how they complement one another, social effects and environmental footprints, the viability and dependability of the WSN system, the costs associated with its implementation and upkeep, and the energy efficiency of every aspect of the system, including its design, sensors, communication protocols, and clustering protocols, and more are among the fascinating topics for further study.

[Dante I. Tapia et. At. 2013]: - A new computer paradigm, known as cloud computing, has recently arisen in response to the exponential increase the quantity of Internet-connected gadgets. The concept of the ambient intelligence (AMI), which is based on ubiquitous computing, suggests new modes of human-machine interaction that enable technology to adjust to the needs of the user. a cloud computing platform for rapid service deployment and integration over WSNs. In order to evaluate the system's effectiveness, it will be used in two real scenarios involving an aged care facility and a fire department.

[Liangtian Wan, et. At. 2015] :- A network of battlefield surveillance systems can be created by connecting the various battlefield surveillance systems together. A battlefield surveillance system's architecture is built using cloud computing for mobile. In this study, direction-of-arrival (DOA), polarisation estimation, cloud computing for mobile, and mobile wireless sensor networks are all utilised. Since the environment in the deployment zone is complicated, earlier work on conformal arrays will be extended into the estimate of MWSN parameters.

[Gabriel Martins Dias, et. At. 2018] :-To design and build a system architecture that uses wireless sensor networks and is scalable (WSNs). Networking that is specified by software is used in the implementation (SDN) characteristics to make managing WSNs simpler and makes use of the processing capacity of current cloud platforms for an algorithm that uses reinforcement learning and bases judgements on how the environment changes. Online data analysis and self-management capabilities that result from the application layer connectivity of multiple management processes are what set WSNs apart from traditional WSNs.

[Regin, et. At. 2021] :- This wireless sensor network defect detection is totally distributed. Convolution Neural Network (CNN) and Naive Bayes classifier are used to enhance convergence performance and identify node problems. The CNN algorithm has faults that are easier to spot than those in the convex hull method based on performance measures and energy efficiency. In wireless sensor networks, the nave Bayes and CNN increase energy efficiency and pinpoint system issues. The application of the suggested charging mechanism will be evaluated and tested in a practical environment.

[Himanshu Sharam, et. At. 2021] :-Today, machine learning (ML) and artificial intelligence (AI) have developed a number of techniques that have the ability to control the effective automated functioning of Internet of Things (IoT) nodes put in urban areas. In the soon-to-be-released Internet of Things-based solution for smart cities, machine learning techniques will be applied. In the cellular IoT, high-performance machine learning algorithms will be deployed networks of the next generation of smart cities.

[Werner kurschl, et. At. 2015] :- Cloud Computing is a brand-new paradigm for software that runs on the internet. The distributed design is similar to a typical wireless sensor network in many ways, including which is in charge of sensing and local pre-processing integrated by wireless connections. Since the fundamental architecture is the same, It has a wide range of applications and circumstances. in wireless sensor networks employing the paradigm of cloud computing. The current approach implements the assessed in many use situations to assess its benefits and disadvantages. In order to perceive and gather environmental data for analysis, wireless sensor networks are deployed.

II. Methodology

In this suggested work, we employ techniques like the Classification, Naïve Bayes, Training data, and testing data. Only nearby nodes can exchange messages in the convex hull algorithm. To enhance the power and convergence performance of a wireless sensor network, the classification performs well and in training data and testing data of Naïve bayes Comparing the Classification technique to other techniques, it performs better.

Classification:

A process known as classification uses a set of data used for training that includes observations or examples whose category membership is known to determine which of a set of data (subset) new data belong to. supervised learning, unsupervised learning, and semi-supervised learning are the most often used classification techniques. When new data is presented, supervised learning can be used to produce an accurate result because it is trained on a specified set of training instances. Based on data with labels, the paradigm operates. The paradigm of unsupervised learning provides a large amount of data from which the pattern must be extracted. On the basis of unlabeled data, the procedure runs. A paradigm known as semi-supervised learning makes use of both labelled and unlabeled data**.**

A helpful perspective for comprehending and assessing a variety of learning algorithms is offered by the Bayesian classification. In addition to calculating actual probabilities of hypotheses, it is resistant to input data noise.

Classifying Data:

By The dataset would be trained using model learning, the kernel function, cross-validation, and professional experience on a subset of the dataset with the selected attributes. The classifier model would be used to classify test data after the dataset had been trained.

Training Data:

Learning from data and making decisions immediately are two steps in the suggested technique for flaw identification. During the essential components of the data are respected and preserved during the data learning phase. A statistical learning methodology is also used in the data learning step. Because of the classification based on data learning, the experience from the expertise needed to tackle various problems impacting WSNs is employed in learning data terms. Permits the use of knowledge in making judgements. The cluster head in a WSN implements classifiers and the decision function for aggregating accuracy data. To categorize any fresh information being collected from sensor node members a real-time decision function in CHs is to be established.

Results And Discussions

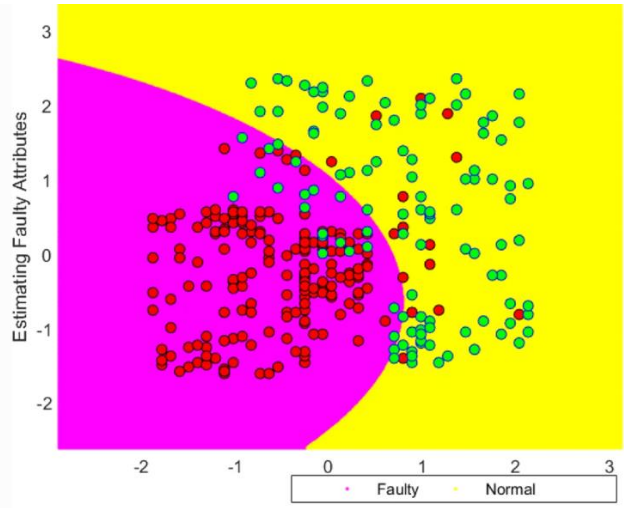

Fig.4 (a): Result of visualizing Naive Bayes (Training)Data.

The characteristics, a network's condition, as well as temperature, humidity, and light, may be "normal" or "faulty". If the property is in the "regular" class, the network has no faulty sensors, as an example of the network state. Otherwise, in both the training and testing phases. There is at least one faulty sensor in the system. The gathering dataset comes from an external multi-hop WSN and contains a total number of samples, including temperature readings taken throughout a 10-min packet scheduling loop over the course of an hour.

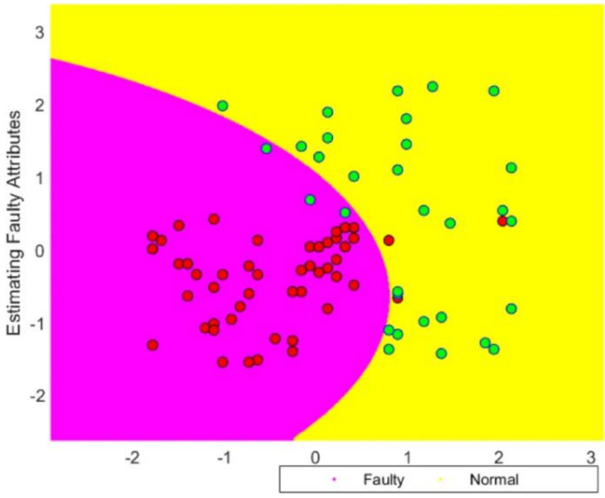

Fig.4 (a): Result of visualizing Naive Bayes (Testing)Data.

The experimental results of the proposed method for the temperature collection classification dataset are compared with those of techniques such support vector machines, naive bayes classification, classifying data, and cloud computing scheme in terms of the false positive rate of the training set. The Hausdorff metric is a mathematical technique for measuring the separation between two datasets. To evaluate how well the suggested plan performs in light of alternative strategies.

III. Conclusion And Future Work

This work presents a novel data categorization strategy based on the naive Bayes approach for data aggregation in cluster heads (CHs) in hierarchical WSN. Because many effective WSN applications need precise data, In CHs, a classification judgement function should be built for defective detection in order to aggregate the regular data for the next procedure. To collect and transmit environmental data to the base station, such as temperature, humidity, and pollution levels, it is classified as gathering "fault" or "normal" data (BS).

The majority of the system design for the suggested method includes elements like data collection and preprocessing, attribute identification and normalization, and training and testing datasets. The data is cleaned up to make it possible to acquire more accurate results. Accurate detection is made possible by the components of chosen attributes in datasets. In the experimental portion, naive Bayes classification was used to acquire data in order to test the system. It demonstrates that, when compared to other methods in the literature, such as the support vector machine (SVM), decision tree (DT), Naive Bayes Classification in addition to classifying data, and cloud computing scheme, the suggested technique offers an effective means of delivering the appropriate data for WSN applications (CLOUD). The method consistently delivers accuracy of higher than 97%.

Future study may integrate the neural network method with some efficient methods for choosing the optimum classification parameters to further enhance the suggested approach.

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