Commentary

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International Journal of Advanced Research in Electrical Electronics and Instrumentation Engineering

2022
Vol.5 No.12:56

Cloud Computing to Improve Air Quality

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Received date: November 15, 2022, Manuscript No. IJAREEIE-22-15689; **Editor assigned date:** November 17, 2022, PreQC No. IJAREEIE-22-15689 (PQ); **Reviewed date:** November 28, 2022, QC No. IJAREEIE-22-15689; **Revised date:** December 08, 2022, Manuscript No. IJAREEIE-22-15689 (R); **Published date:** December 15, 2022, DOI: 10.36648/ijareeie.5.12.56.

Citation: Cooper T (2022) Cloud Computing to Improve Air Quality. Int J Adv Res Vol.5 No.12: 56.

Description

In densely distributed networks, low cost air pollution wireless sensors are emerging that offer greater spatial resolution than typical conventional systems for monitoring ambient air quality. A distributed sensor network connected to a cloud system to form a Wireless Sensor Network (WSN) is the basis for the air quality measurement system described in this paper. Sensor nodes transmit field measurement data to the cloud *via* a gateway and are based on ZigBee motes that consume little power. To store, monitor, process, and display the sensor network data, an optimized cloud computing system has been implemented. Utilizing techniques from artificial intelligence, data processing and analysis are carried out in the cloud to maximize the detection of compounds and contaminants. Because a large number of nodes can be deployed and provide pertinent information for air quality distribution in various areas, this proposed system is a low cost, low-size, and low power method that can greatly improve the efficiency of air quality measurements. Lastly, a case study conducted in a laboratory demonstrates that the proposed system can be used to detect several common volatile organic compounds, such as: xylene, benzene, toluene, and ethylbenzene. Data processing has utilized principal component analysis, a multilayer perceptron with backpropagation learning algorithm, and a support vector machine.

Cloud Computing

The term cloud computing refers to the on demand availability of computer system resources, particularly computing power and data storage, without the user actively managing them. Big clouds frequently have functions spread across multiple locations, each of which is a data centre. Coherence is achieved through the sharing of resources, and cloud computing typically employs a model, which may result in unexpected operating costs for users as well as a reduction in capital expenditures. That cloud computing aims to make it possible for users to benefit from all of these technologies without having a deep understanding of each one. The primary enabling technology for cloud computing is virtualization, which aims to help users focus on their core business rather than being hampered by IT obstacles. Software for virtualization turns a physical computer into one or more virtual computers that are easy to use and manage for computing tasks. Idle computing resources can be allocated and utilized more effectively through operating system level virtualization, which basically results in the creation of a scalable system consisting of multiple independent computing devices. By increasing infrastructure utilization, virtualization reduces costs and provides the agility necessary to accelerate IT operations. The process by which the user can provision resources on demand is automated in autonomous computing.

Online services that offer high level APIs for abstracting various low level details of the underlying network infrastructure, such as physical computing resources, location, data partitioning, scaling, security, and backup, are referred to as infrastructure as a service. The virtual machines are operated as guests by a hypervisor. The cloud operational system's pools of hypervisors are able to accommodate a large number of virtual machines and can scale services up or down to meet the varying needs. Linux containers are run on separate partitions of a single linux that is installed directly on the hardware. Because there is no overhead associated with the hypervisor, containerization provides superior performance to virtualization. The consumer is able to deploy and run arbitrary software, which can include operating systems and applications. Additional resources offered by IaaS clouds include a virtual machine, disk image library, raw block storage, file or object storage, firewalls, load balancers, IP addresses, Virtual Local Area Networks (VLANs), and software bundles. While operating systems, storage, and deployed applications are under the consumer's control, the underlying cloud infrastructure is not managed or controlled by the consumer; IaaS cloud providers supply these resources on demand from their extensive pool of equipment installed in data centres, and possibly limited control of specific networking components can connect to wide areas by using carrier clouds or the Internet. Cloud users install operating system images and application software on the cloud infrastructure to deploy their applications. Operating systems and application software are patched and maintained by the cloud user in this model. IaaS services are typically billed on a utility computing basis by cloud providers: cost is a reflection of how many resources are allocated and used.

Air Quality

The availability of affordable instruments for the measurement of air pollutant levels is crucial to the protection of both humans and the environment because poor air quality poses the same global threat as unhealthy diets and smoking. A wearable device with low cost Metal Oxide Semiconductor (MOS) gas sensors, a PM sensor, and a smartphone for Bluetooth Low Energy (BLE) data collection comprise our air quality monitoring platform. Our own app shows information about the air around the user and sends the collected geolocalized data to a cloud, where users can map the network measured air quality levels. The resulting device has a user friendly interface, is lightweight, compact, and can be worn on the belt, and costs little. A high performance framework must be developed to support system monitoring, performance evaluation, data storage, and abnormal situation alerts, end user services, and even provide processes to obtain new knowledge about the data because wireless sensor networks have the capacity to generate a large volume of data that grows over time. This section aims to present a cloud framework for controlling and monitoring wireless sensor networks. It provides services to store data and use intelligent mechanisms for data classification and visualization in addition to storage. For air quality monitoring in wireless sensor networks, a low cost, low power, and small node has been developed. A widespread sensor network can be built with a large number of nodes thanks to these features. Preprocessing the data before sending it reduces its dimensionality and connects the nodes directly to the cloud, where it is stored, processed, and displayed, thanks to the use of a gateway. The network's goal is to find air pollutants across large areas. By detecting and quantifying volatile organic compounds, its effectiveness has been demonstrated. For this purpose, pattern recognition methods have been utilized. The system performed well in both tasks, with determination coefficients around in the quantification tasks and success rates of discrimination.