The Role of Cloud Computing in Smart Cities

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Abstract: With smart cities, people's living areas become better and their living standards rise. People can easily access the information they want and plan accordingly. In this way, they live a better quality and productive world. They can also remotely control and direct any smart system at home, in his car or in his office, regardless of time and location. In addition, thanks to intelligent systems, government agencies can control different parts of the city as well as foresee and take precautionary damages. Health, military, industrial, environmental, agricultural, logistics, transportation systems are realized with economic and social gains. All these smart systems require infrastructure. There are many technical and financial needs such as the servers that the devices that make up the systems can send the data, the servers where these data will be stored, the maintenance and security of these servers. At this point, Cloud Computing emerges. Cloud computing, a new generation of topics, is the general name of Internet-based IT services that can be used by computers and other devices at any time and provides shared resources among users. With Cloud Computing, users can access the system from anywhere on the internet. Cloud Computing is becoming a part of technologies in smart cities with its success in cost, global scale, speed, performance, efficiency, security and reliability. With cloud computing, servers, storage areas, databases and numerous application services are easily accessible over the internet, making integration of the systems in smart cities and the exchange of information between them more constructive. In this study, the role of Cloud Computing in smart cities will be explained. The current literature review will reveal the latest trends in these two areas. The study is considered to be beneficial for smart cities technology developers.

Keywords: Smart city, Cloud computing, Infrastructure, Living, Technology

Introduction

With the development of cloud computing and the rise of smart cities, smart city cloud service platforms are increasingly recognized by businesses and individuals. The data detected by thousands of smart devices that make up smart cities and provide data exchange can be stored in cloud systems. This makes it easier to exchange the data needed for different systems.

However, since all data collected are on the same platform, all processes related to this system need to be analyzed very well. While an efficient cloud system will make everything more accessible, in an inefficient cloud system all data can become more complex.

In this study, the current studies on cloud computing in smart cities are shared with the elements of smart city.

Smart City

According to the European Commission, a smart city is a place where traditional networks and services, city dwellers and business is made more efficient by the use of digital and information communication technologies. Some of the systems found in smart cities, as shown in Figure 1, are as follows.

Smart Industry, Smart Security, Smart Energy, Smart People, Smart Health, Smart Home, Smart Mobility, Smart Governance, Smart Retail.
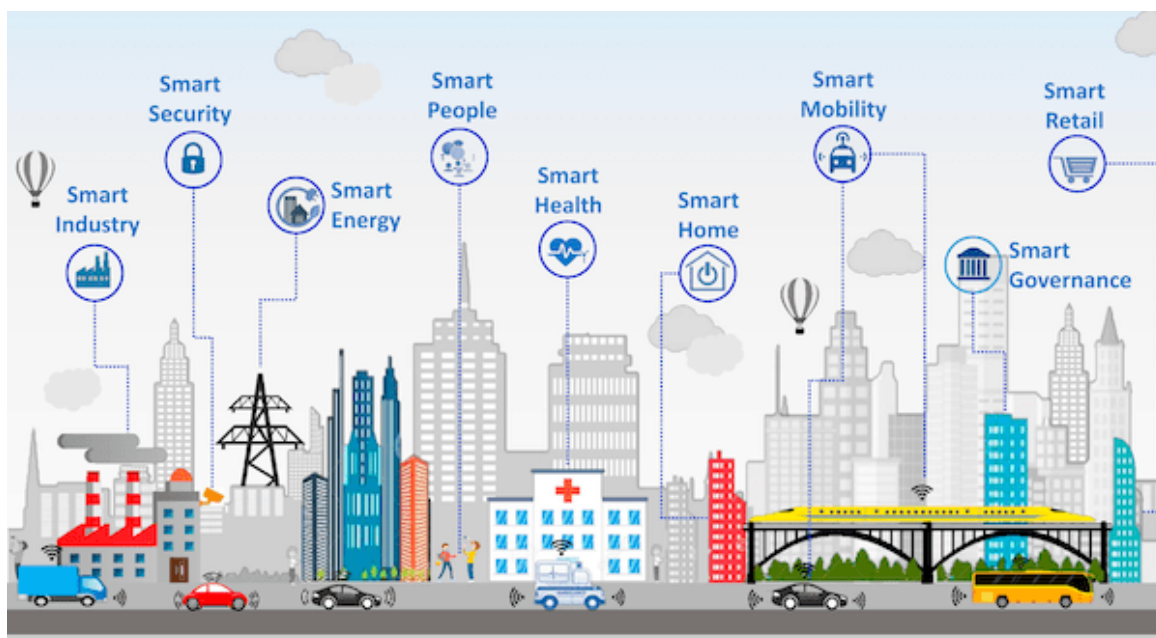
Figure 1. Smart City [Silva et al., 2018]

Smart city aims to improve the quality of life of citizens by creating sustainable mechanisms. In this respect, the issue of smart city should be considered as a concept that includes different economic, humanitarian or legal elements instead of being seen only as a technological issue. The main objective of the smart city initiative is to ensure the sustainability of cities, to increase the social activities and to facilitate the living conditions.

Cloud Computing

Cloud Computing, a new generation of topics, is the general name of Internet-based IT services that can be used by computers and other devices at any time and provides shared resources among users. With Cloud Computing, users can access the system from anywhere on the internet.

Cloud Computing is becoming a part of technologies in smart cities with its success in cost, global scale, speed, performance, efficiency, security and reliability. With cloud computing, servers, storage areas, databases and numerous application services are easily accessible over the internet, making integration of the systems in smart cities and the exchange of information between them more constructive.

Studies on Cloud Computing in Smart Cities

When the literature is examined, it is seen that there are many studies on cloud computing in smart cities. The most recent of these studies are described below.

The study [Araujo et al., 2019] presents a comprehensive performance assessment of FIWARE, a cloud-based IoT platform developed by the European Commission.

In the study [Jegadeesan et al., 2019], it has been stated that the number of mobile users has increased considerably recently. While users are using mobile applications, they can also exchange data from various cloud services. The study proposes a new authentication technique in order to ensure security between the end user and the service provider.

In the study [Huang et al., 2019], it is stated that it is very difficult to efficiently query the data pool in smart city cloud systems. Accordingly, a new technique is proposed for interrogation.

It is stated that [Esposito et al., 2019] although cloud computing is a very useful technology, it has security and privacy concerns. For this purpose, data access restriction technique has been developed when access to the same cloud from different sites.

In the study [Sinky et al., 2019], the caching and placement approach for circulating data within the network is suggested in order to be more positive in terms of data acquisition speed, network traffic congestion, memory usage efficiency for cloud computing to be more effective.

In the study [Sun et al., 2019], a new queue model is proposed to evaluate the demands coming to the cloud, to reduce delays and to respond to normal requests faster.

In the study [Alabdulatif et al., 2019], a cloud-based model for anomaly detection is presented to obtain accurate information from the data collected in smart cities and to operate a good decision-making mechanism.

The study [Khattak et al., 2019] proposes a new framework that integrates vehicle clouds and IoT.

In the study [Han et al., 2018], it is stated that data produced in smart cities are stored on cloud servers and privacy and integrity of stored data should be ensured. Therefore, a new cloud audit program has been proposed.

The study [Al Ridhawi et al., 2018] proposes a new technology to increase the performance and diversity of existing vehicle cloud services in smart cities.

In the study [Bangui et al., 2018], it is stated that cloud computing techniques are used to reduce costs, manage resource consumption, increase performance and connect IoT devices more effectively. Accordingly, a new intermediate layer is proposed by using fuzzy similarity and TOPSIS methods which cloud computing techniques should be used.

In the study [Liu and Lian, 2018], the minimum number of copy approaches for data security is proposed. For this purpose, a new replication strategy based on access pattern mining is proposed.

The study [Wang et al., 2018] proposes a new cloud-supported, lower latency, real-time framework for smart cities.

In the study [Barra et al., 2018], cloud based biometry services for smart cities are investigated.

The study [Eirinaki et al., 2018] proposes a new cloud-based framework to assist citizens and city authorities in the construction permit process.

The study [Hossain et al., 2018] proposes a new cloud-supported framework for secure video transmission and sharing.

In the study [Mazza et al., 2018], there are many smart mobile devices in smart cities and a new method has been developed with randomized algorithms in order to ensure fair allocation of resources to these devices.

In the study [Massobrio et al., 2018], big data analysis is performed using cloud computing infrastructures. Two case studies were analyzed using the historical bus location data, the service quality assessment of the public transport system, and the estimation of passenger mobility using ticket sales data from smart cards.

In the study [Yang et al., 2018], a decentralized image acquisition method is proposed for cloud computing based multi camera system for smart cities. The combination of cloud storage technology, data encryption and data retrieval technology enables efficient integration and management of multiple camera resources.

The study [Cheng et al., 2018] proposes a standard-based approach to design and implement FogFlow, a new sis-based framework for IoT smart city platforms.

In the study [Chen and Tsai, 2018], a new mobility management is presented using the follow-me cloud-cloudlet (FMCL) approach proposed in fog computing based radio access networks for smart cities.

The study [Enayet et al., 2018] proposes an optimal mobility-sensitive resource allocation architecture for remote big data task execution, providing greater efficiency in time and reliability in mobile cloud computing.

In the study [Simon and Mester, 2018], cloud based IoT platforms for smart cities are analyzed.

In the study [Miao et al., 2018], a new keyword search scheme based on verifiable attribute is proposed. In this way, it allows users to check and obtain the accuracy of the search results.

In the study [Kurdi et al., 2018], a trust management system is needed to help reliable peers when looking for reliable communication partners and a new trust management system is proposed.

The study [Muhammed et al., 2018] proposes a new cloud-based network health system for smart cities.

Conclusion

The work done with cloud computing in smart cities is increasing day by day. Studies are focused on using the cloud more effectively and safer. Many services in the smart city make it easier to access city services by expanding them with cloud systems. Cloud computing systems integrate data from many different sources over the network.

Cloud computing systems enables infrastructure, software and platforms to be used with common service logic. It offers both large enterprises and small entrepreneurs the opportunity to store large data, instantly access and operate without hardware, and share with third parties.

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