

Smart City with Reference to Perception, Features, and Stakeholders

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ABSTRACT

Smart city is the advancement of the city or it is called intelligent city. Technology is more advanced and updated in this age. New modern technologies are invented in regular basis and also existing technologies are upgraded continuously. The life style of the people is also changing in this modern age. Nowadays, the people who are residing in the urban area or cities; moreover, they are much depending on the modern technologies. New cities or existing cities need to be constructed as a smart city due to the demand of advanced opportunities, facilities, services, and to build a better life. Smart cities are build by automate the different services with the help of modern technologies. This paper highlights the different aspects of smart cities. This paper describes different features and natures of smart cities. It also highlights on the stakeholders associated with the smart cities. It also describes the prime advanced technologies are used to build smart cities.

Keywords: Smart City, E-Governance, Smart Transportation, Smart environment, Smart Education, Smart Economy, ICT Applications, Digital Society

The city is the advanced urban area where citizens get all the advanced services and facilities. Every city is build up with many people; many people are living in the cities for avail better opportunities in different sectors including education, healthcare, employment, shelter, and accommodation. Therefore, many people want to living in the cities to getting better quality life. The life style adopted by the people is changing very fast due to the advancement of the technologies and progress of the age. Moreover, the demand of the people to improve the life style gradually increased every day^[29]. Nowadays, new emerging

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technologies are discovered daily and the use of these modern technologies are increased rapidly in various fields. Therefore, Smart city is very essential to provide better quality services and better life to the citizens. Due to the growth of the population in the cities, smart cities need to be developed. Smart city is a modern city which is developed with the help of latest advanced technologies^{[8],[12],[16]}. New cities are constructed or existing cities are redeveloping as smart cities. The latest technologies are used to implement many applications in several sectors that provide faster services and facilities to every citizen of the smart cities^{[1],[2]}.

The smart applications are required to be developed, to automate many task and control many activities automatically. Many smart applications are developed using emerging technologies. Digitalization of the work is one of the implementation of technology to automate the services. IOT is the prime technology to build up many smart applications for the development of the smart cities^{[17],[13]}. There are other technologies are associated with IOT used to build the smart applications. Big Data, Cloud Computing, Block Chain technologies are used with IOT technology.

This paper describes about smart city and also focuses on the many features, nature of the smart cities. It also explains how the technologies are utilized to make smart applications that are implemented in various projects for the development of the smart cities. The different stakeholders are associated with smart cities are also explain in this paper.

Features and associates in Smart City

Smart Systems are developed in every sector to provide better and smart services. There are different features of smart cities such as—

- ❖ Provide many government and other services to every citizens with the help of information technology and other modern technologies.
- ❖ Re construct new areas or places for better accommodations of the people in the city. More unused places or lands are utilized or clustered for development of the smart city.
- ❖ Elevate the infrastructure in different sectors including healthcare, education, social, and economical.
- ❖ Develop smart services to improve the transportation system in the smart city. Smart transportation system is developed for better communication and mobility.
- ❖ Build or develop free places in the smart city including parking area, play ground, and other areas.
- ❖ Make eco-friendly city for better living and make clean environment.
- ❖ Develop safer place for living by monitoring suspicious activities in any places or any disaster happened in the place^{[34],[35]}.

There are some associates of smart cities according to the following features of smart city. The associates are Smart Living, Smart Transportation, Smart Governance, Smart Economy, Smart Education, Smart Healthcare, and Smart Environment^{[4],[5],[6]}.

Associates in Smart Cities

Smart Living

Resident of the smart cities gets facilities from the different smart applications. Various kinds of applications are there to provide the services and facilities to improve the living in the cities. Smart home, smart parking system, smart security systems are some applications to provide better services for smart living.

Today, most of the people depend on the electronics appliances and gadgets for better living. Electronics gadgets and home appliances not to be smart enough. Therefore, IOT applications are implemented to operate these electronics devices automatically in home or outside home.

Allotment of car in parking place is one of the major problems due to increase the use of vehicles. The Smart applications using IOT technology are developed to allocate spaces for the vehicles within limited parking place.

Implement smart security system is very important today to ensure the security for every citizens. CCTV surveillance is launched in various places to continuous monitoring for any suspicious activities are happened in the cities^{[20],[32]}.

Smart Transportation

The transportation is very important in the city for make strong communication, social or economic development purposes. The smart applications are developed for transportation with the help of emerging technologies including IOT technology. Many applications regarding transportation such as location tracking of vehicles, free parking place detection, movement of the vehicles, monitoring peoples who are traveling through vehicles, monitoring the capacity of the vehicles to carriage the goods, identification of vehicles during fee collection etc.^[19]. Therefore, many smart applications build up for transportations to provide smart and faster services to every citizens in the city.

Smart Governance

Implementation of smart governance system is another feature of smart cities. The main strategy is to provide government services and facilities efficiently to the every citizen who resides in the smart cities. E-governance is the smart solution for the implementation of smart governance. E-governance is developed with the help of IT, and Information Communication Technology ICT. So many government services are provided through e-governance with help of digital technologies^[32].

Smart Environment

Every cities need to be provide clean and pollution free environment for every resident. This is the major issue in the world to make clean and sustainable environment. Every country facing several barriers to make clean and sustainable environment. It is very essential to build smart environment in the smart city. Some of the smart applications to make smart environment are measuring temperature, humidity, and forecast weather using sensors. Many experiments going on to make smart solutions for the environment^[21].

Smart Economy

Economy is one of the aspects for development of the cities or country. Development of the business is required to economically develop the cities. Therefore, smart economy is one of the key features to build a city as a smart city. Advanced technologies are utilized to implement smart economy in the smart city. The smart applications like e-Business and e-Commerce and many other business oriented applications are developed with the help digital technologies. Use of these applications generates more revenue that helps to improve the economy of the smart city^[4].

Smart Education

Education is one of the prime things to build better life. It is very essential to provide better education for every people of the country. Today, education mode and also traditional education system is changing very fast due to advancement of the technologies. Many modern methodologies are applied in education system using latest technologies. Smart education system is developed by technologies and that give best education. E-learning, online education, are the smart education system which are developed with technologies.

Smart Healthcare

Management of healthcare system is the challenging task. The main aim of the smart healthcare to build strong and more efficient healthcare system. Smart solutions are applied to automatically manage, operate various tasks or work regarding healthcare. Many smart applications are developed for the implementations of the smart healthcare system. Some of the applications are patients activities monitoring, smart pill is the new invention in drugs, smart devices used in medical clinics, smart medical devices are used for diagnosis. The various information technologies are used in healthcare system like IOT, Big data, AI, Machine Learning, Block Chain to make intelligent healthcare system^[23].

Smart Waste Management

Waste management is one of the problems in city. Smart solutions are required to manage waste efficiently in the smart cities. Moreover, various initiatives have taken to manage waste in the city. A smart application is need to be developed to manage waste very efficient way^[36]. Here Fig. 1 describes associates of Smart City.

Stakeholders in Smart City

Various stakeholders are associated with the smart city and main stakeholders are technology, citizen, government, and private organization^{[7],[17]}. The stakeholders of the smart cities are as follows:

1. Technologies

Technologies are the stakeholder to develop smart city. Technologies are categorized as Hardware, Network, Software, Database, IOT, Machine Learning, Deep Learning, Artificial Intelligence, Cloud Computing, Big Data, and Block Chain.

(a) Hardware

Hardware technology is the main core part of the implementation and execution of task automatically. Therefore, hardware is the electronic devices that used to execute tasks automatically. Various hardware is used in different area to develop smart city. Some of the hardware technologies are computer devices, network devices, IOT devices, Servers^[15] etc.

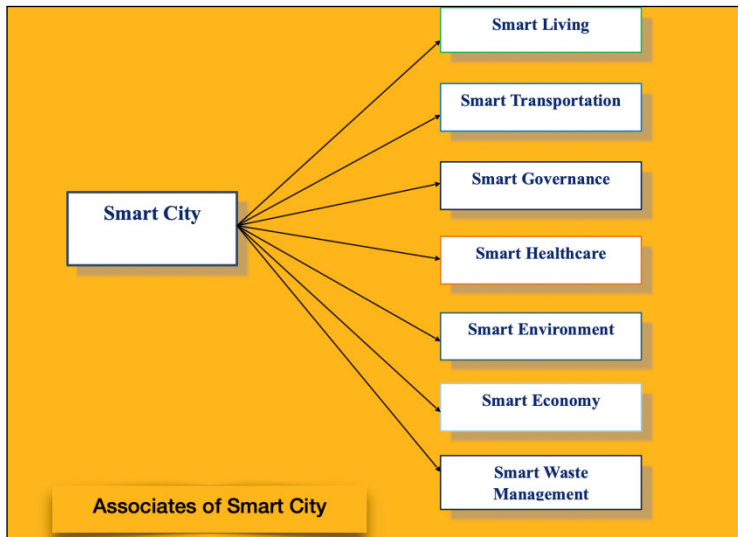


Fig. 1: Associates of Smart City

(b) Network

Network is the various linked computing devices used for data communication purpose. Data communication is the part of networking and data communication is the sharing of data with the target connected devices. Without network unable to communicate with the peoples. Therefore Network is very important technology to implement any smart city based projects. Internet is one of the largest networks today; everyone has depended on internet for communication, Information sharing, and many other services provided through Internet^[22].

(c) Software

Software is the coding technique to implement any tasks. So, the software play vital role to develop any system digitally. As every software runs on the hardware, there are different kinds of software according to the hardware platforms. Software also applied to develop many automated systems under smart city projects. Web based applications, mobile based application, workstation based application, server based applications are examples of software^[9].

(d) Database

Database is the data store or storage of data. Data need to store in the database for further utilization.

Therefore, data is permanent in database, and it creates a knowledge and experience in the future. Database also is one of the stakeholders of technology for the application of smart city projects.

(e) IOT

IOT is the advanced emerging technology that plays the important role to build smart solutions for smart city based projects. IOT has many components including hardware and software. Hardware of the IOT is different sensors, actuators, RFIDs, core devices. Software is used to processing data and creates information. Sensors collect data and send it to the remote computing devices through the network for processing and make meaningful information. Some popular smart city based IOT projects are smart parking place management, smart traffic management, smart transportation, smart healthcare, smart living etc.^{[15],[27]}.

(f) Machine Learning and Deep Learning

Machine learning and deep learning are the mathematical based techniques that are used in data analysis and processing purposes. After collection of data, data analyzed by applying these mathematical techniques to extract knowledge and information^[11].

(g) Artificial Intelligence

Machine is not much intelligent device like human. Artificial intelligence techniques are applied to make the machine intelligent as human. Artificial intelligent technology is used to make any machine smart as human and applied on IOT based projects. Therefore artificial technology is also a part of stakeholders in smart city^[33].

(h) Cloud Computing

Cloud computing is the collection of resources which are virtually provided to the users as per the need for utilization. Cloud computing is essential technology that is used to make any application without much resources. Moreover, Cloud computing technology is also implementing in smart city based projects [24].

(i) Big Data

Big data means massive data, it is much complex to process and store massive amount of data. Although, there is a big data technology to manage this huge amount of data. Therefore, big data is one of the stakeholders in the smart city project to manage by big data^[3].

(j) Block Chain

Block Chain technology is one of the emerging modern technologies and it has many applications in different fields. Block chain technology is the decentralize system where different nodes contains information for any transaction. The main purpose of block chain is to ensure secure transaction. This technology is used in smart city development projects to ensure security of the city or any other security purposes^{[10],[14]}.

2. Citizens

The main goal of the smart city based projects implementation is to provide better quality services among the peoples who are living in the cities. Thus, citizens are one of the stakeholders in smart city and are involved to get services from different smart city based projects. Smart city based projects are useless without involvement of the citizens.

3. Government

Different ministries and advisories of Central Government and state Governments are associated with this smart city projects and they are the main stakeholders. Central governments execute plans or proposal of the projects with the help of State Government. Ministry organizations, institutions, government affiliated organizations, staff, and advisories are involved in this project^[31].

4. Private Organizations

Many national and international private organizations and institutions are associated with to implement smart city based projects. Consultancies, agencies, consultancy firms are involve managing, coordinates, implements projects. Government assigns consultancies to the projects according the plans for development^[30]. Fig. 2 shows Smart City Stakeholders.

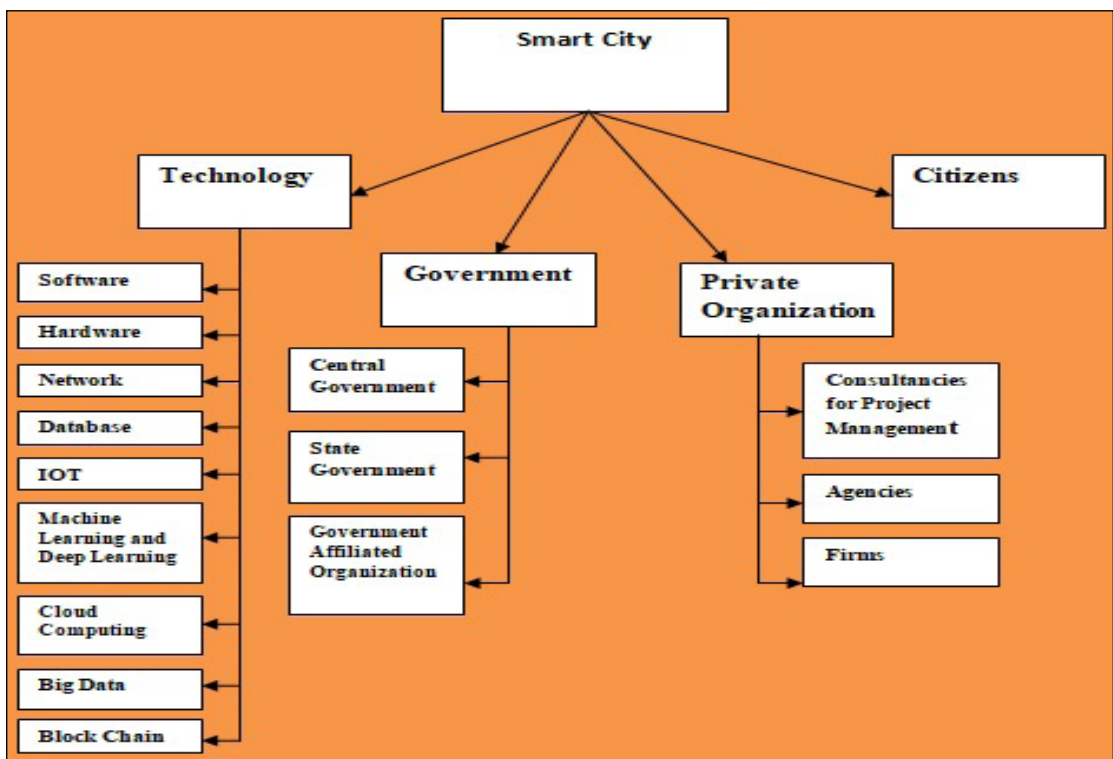


Fig. 2: Smart City Stakeholders

CONCLUSION

Importance of the smart city is increasing day by day. Many kinds of research and development are progressed in many sectors for the development of smart city. As the various advanced technologies are improved daily and new innovations are progressed continuously, demand of the smart city is very high. Many smart cities have been developed since last decade. Now, the development of the smart cities still going on. New smart cities being developed and also existing cities are redeveloped as a smart city. The development mainly emphasis on infrastructures of city and others sectors, environment, social, and economical. This paper accentuation on about smart city and the nature of the smart city. The various features are described in this paper. Features are classified as per the development of many sectors with the modern technologies. The various stakeholders are associated with this smart city project also explain in this paper. Stakeholders also classified according various technologies, people, citizens, government, and many organizations are involved in smart city project implementation.

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