



# A Review On Core Infrastructures For Establishment Of A Smart City

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**Abstract:** As urbanization is proliferating over the last few years there is an indispensable need for intelligent technology, digital surrounding, smart governance, and a sustainable environment to improve the quality of human life. As an outcome of the knowledge-based economy and accelerated development of technology Smart city is a combination of internet, network, sensors, etc. For implementing all the applications an emerging technology Internet of Things (IoT) acts as a backbone or one can say IoT is reaching urban living. The features and devices of smart cities are becoming smarter. The parameters like urban sustainability, infrastructure efficiency, and economic growth can be improved by the intervention of IoT. The aim of this chapter is to provide a comprehensive view of smart cities, its concepts, components and emergence. The table mentioned represents the established relationships between various sectors of industries and its services. Further in chapter the impact of smart cities on areas of science, technology, and society is illustrated. The focus is given to key applications, technologies and challenges related to IoT which are used in smart cities. The perceived concept of the smart city initiative will always remain critical for development and sustainability. The Future city is Smart and Economical.

**Index Terms - E--Governance & Citizen Services, Energy & Green Management, Industrial & Agricultural Management, Li-Fi Technology, Urban Mobility, Water Management.**

## I. INTRODUCTION

'Smart City' is a mission or a project by the Governments of different countries to make a better world. To provide for the aspirations and needs of the citizens, urban planners are ideally aiming at the development of the entire urban eco-system, which is represented by the four pillars of comprehensive developmental - institution, physical, social, and economic infrastructures. This can be a long-term goal and cities can work towards development for the betterment of infrastructure and adding on layers of smart technology.

The main objective is to promote cities that can provide core infrastructures and give a decent quality of life to its citizens, a clean and sustainable environment and application of 'Smart' solutions with advanced technology (5G Technology).

The Smart City Mission of the Government is a bold, new initiative with the advancement of technology and applications in various regions and parts of the country. The core infrastructure elements in a smart city would include:

1. Water supply.
2. Power and ICT system (Information and Communication Technology).
3. Waste management.
4. Industrial effluent system.
5. Smart road networking and signal management.
6. Advance eco-system.
7. Renewable energy sources.
8. Smart governance system.
9. Advance health, education, and emergency services,

10. Safety and security of citizens, particularly women, children, and senior citizens, etc...

## II. RELATED WORKS

Different studies on smart city are available in the scientific literature. Therefore, we analyzed relevant related work to clarify our position in existing research. In contrast to existing literature reviews, this research captures a holistic view on the broad research area of smart cities. It presents a high-level summary of smart city research and clusters the topics in well-known and accepted dimensions for smart city research. Although some main dimensions are already described in literature, to date, research has not evaluated the popularity.

Xiaohong Chen [1] examined the problems related to the construction of the smart city by involving various new technologies for the better way of lives of the people. Kehua sun et al. [2] proposed the construction and management of a green environment with urban mobility and smart transportation systems, along with well-constructed infrastructure to sustain and for the well-being of a better environment. Kincho H. Law et al. [3] proposed the technologies for developing the environment free of pollution and conserving the energy with renewable sources for smart city. They discussed about the challenges also. Edward Curry et al. [4] also proposed the services that can be enabled with smart applications by using smart appliances and technology. They showed the way to sustain a systematic and scheduled life with the prosperous use of technologies and its services. Imad Jawhar et al. [5] proposed the use of short band widths for communications and LAN. They proved that it can also be developed for the organizations of large cities and improvement of city resources and reduce the operational cost, thus maintaining a systematic use of energy and resources that can be renewed and recycled with the usage of short band widths for better and effective networking around the cities. Schahram Dustdar et al. [6] proposed a value driven architecture by combining state-of-the-art research with industrial developments containing of research road maps for future Smart Cities, Internet-of-Things and social computing research. Joshi Sujata et al. [7] proposed a framework with the 6 significant pillars for development (SMELTS).

Khushboo Gupta et al. [8] proposed the Indian perspective of Smart City Mission (SCM) a national initiative by Ministry of Urban Development (MoUD). Nicos Komninos et al. [9] proposed the bibliometric analysis for the research of Smart Cities and thereby exploring the bigger picture of the concept and idea. Parul Gupta et al. [10] proposed the descriptive study, review and research of the classification of Smart City.

## III. STRUCTURE ELEMENTS

The Proposed Systems are the infrastructure and the fundamental pillars of comprehensive development of a Smart City. These systems have the components and features of: Digital City, Information City and Virtual City in one main-frame city. Promoting smart mixed land uses in urban agriculturally based developments. Smart housing inclusiveness of IoT based smart security system and fast accessibility of emergency services and healthcare services with smart road-map accessibility. Robust IT connectivity using Li-Fi Technology.

Fig. 1 shows the proposed smart city system which includes e-Governance & Citizen Services, Energy & Green Management, Urban Mobility, Water Management, Industrial & Agricultural Management, and Li-Fi Technology. Fig. 2 depicts the radial format of the proposed system.

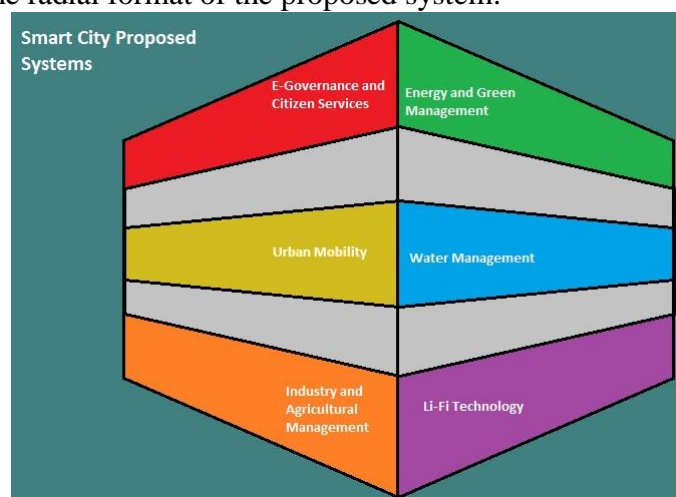


Fig. 1 Proposed Smart City system

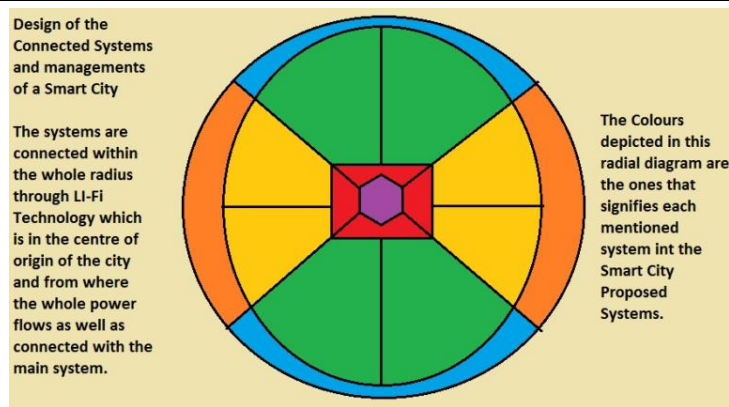


Fig. 2 Radial format of the proposed system

### 3.1 E-Governance & Citizen Services

#### 1) Smart governance system (public information & grievance redresser)

The present “Smart governance system” is a web project developed under the concept of digital governance to manage the whole governing process by means of Aadhar Id integration with all government certified documents.

- Maximum percentage of government services can be accessed by the citizens via advanced web managements and smart phones.
- Percentage of e-gourmet, e-license and online tax filling services and much more are being issued.

#### 2) Smart power supply systems

Smart power supply systems are solutions that realize energy savings and stable supply of electricity using renewable sources. It plays an active role in a variety of locations and contributes to the construction of pollution free smart city.

ICT system: ICT means Information Communication Technology which is the hardware and software that enables society to create, collect and consolidate information in multimedia format using Li-Fi technology.

Fig. 3 shows the E-Governance & Citizen Services.

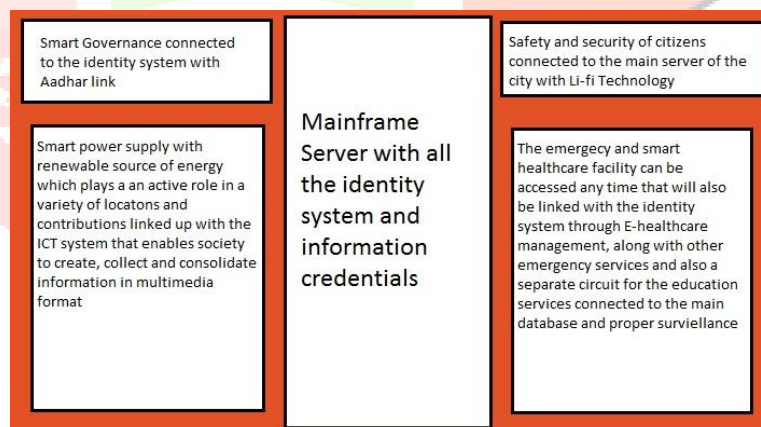


Fig. 3 E-Governance & Citizen Services

#### 3) Smart healthcare and emergency hospitality

Healthcare is related to one of the emergency services. Appropriate healthcare is delivered at the right time and right place with smart accessibility through the e-healthcare management, with smart hospitality management with sanitization as the main domain, accurate and delicate diagnosis, treatment, and emergency cases.

Education services: Education is the main domain in the city with school, colleges, universities, and research centres. Smart classrooms and adequate space management, e-book system to access and kind of educating information from a particular site using cloud web management, advanced teaching stuff and materials, proper and sanitized canteens with proper food.

Emergency services: Emergency services have become one of the most important aspects of a smart city with proper security for human life. There are 3 primary emergency services that can be summoned or accessed by the public through e-emergency like Police, Fire brigade and medical services.

#### 4) Safety and security of citizens (especially women, children and senior citizen)

The concept of a smart city also includes the safety and security of the people living in the city.

First the women of the city must have a special accessibility to the protection of their own in case of rape or harassment or eve teasing. e-safety (direct location and GPS tracking to the nearest police station from the smart phone) must be provided to them and they must use and accuse the culprit with accurate verdict.

Second the children and the senior citizen of the city, with proper respect and security management by e-safety (unnecessary problems and harassment with special e-emergency for the senior citizens), every child going to schools or colleges will have a security chip in their Id cards which they must carry for smart safety measures.

### 3.2 Energy & Green Management

Smart energy sources (WPT, sustainable power, efficient and green buildings): Many of us want to “do our bit” for the environment and there are many good reasons to do so. Preventing pollution, for example, can improve health, protecting wildlife means that we can continue to enjoy our natural world and reducing consumption of preserved resources for the future world.

For organisations, failure to comply with our country’s environmental legislation can result in the prosecution and financial penalties. But greener working practices can also reduce costs and save our money.

1. To manage the green environment:
2. Make recycling easy
3. Control the power usage
4. Switching to renewable energy supplies
5. Planting of trees i.e., increasing greenery
6. Using local transportation system rather than personal vehicles
7. Usage of green building (with efficient use of energy and water resources and usage of renewable: solar energy)

Smart eco-system: The smart eco-system network is a community designed to nature growth of companies and individuals by providing technical resources accreditation programs and marketing support to its members.

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Main components of smart eco system network:

1. Company Accreditation Program (CAP): Offers formal accreditation to organization engaged in a strategic relationship with SMART.
2. Software and Content Accreditation Program (SCAP): Grants accreditation to content and software products that are compatible with SMART products.
3. Developer Accreditation Program (DAP): Grants certification to individuals who have technical proficiency in one or more SMART products.

Fig. 4 shows the ecosystem management.

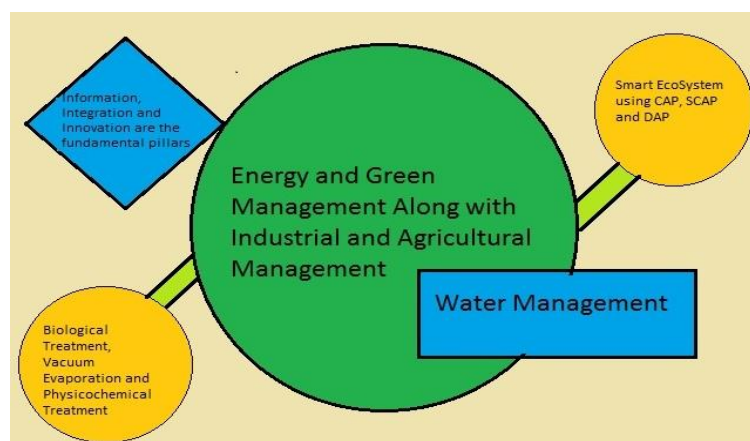


Fig. 4 Ecosystem Management



### 3.3 Urban Mobility

Smart road networking & signal management: Smart signal management is a system where centrally controlled traffic signals and sensors regulate the flow of traffic signals and sensors regulate the flow of traffic through the city in response to demand.

1. Aim of smart traffic management system.
2. Reduce day to day congestion by improving traffic flow.
3. Reduce pollution by limiting traffic jams.
4. Prioritize traffic according to real time changes in traffic conditions.

Working of smart traffic signals: Rather than timers, smart sensors-based traffic signals rely upon a system of sensors to detect when a vehicle is present. When a vehicle is present on the side of a road arrives at the intersection a sensor will detect it and cycle the lights to allow traffic on the side road to pass.

Components: Smart traffic control systems are generally made of three components: -

1. A central Control System
2. Smart traffic lights
3. Camera and queue detectors

### 3.4 Water Management

Smart water management is essentially a system designed to gather meaningful and actionable data on the flow, pressure, and distribution of city water.

Its main goal is to ensure that the infrastructure and energy used to transport water are managed effectively.

Advantages:

1. Integrating a smart water network is a great way for utilities to give new life to investments they have already made.
2. The premise of smart water networks is the use of information technology to optimize a utility's capacity.
3. The 1st step for a water utility to move toward implementing a smart water network is to establish its priorities network is to establish its priorities for improving efficiency. Then, evaluate the information available and identify which pieces of data are missing and could be achieved by integrating the existing.

The fundamental pillars of smart water network:

1. Information: Making full use of all data produced by a water utility.
2. Integration: Utilizing the system to maximize previous investments.
3. Innovation: Having the flexibility to meet future challenges.

### 3.5 Industrial & Agricultural Management

Smart industrial effluent system: Effluent is an outflow of water or gas to a natural body of water, formal structure such as a waste water treatment plant, sewer pipe or industrial outfall. Effluent, in engineering is the stream exiting a chemical reactor.

Industrial effluent is treated with: -

1. Biological Treatment
2. Vacuum evaporation
3. Physicochemical treatment

Use of Smart Technology:

- PLC Plug and Play: It is software that can be integrated to allow a seamless and near autonomous production process to continue the plug and play features Wi-Fi compatible software, allowing control and oversight of various variables to be seen from a tablet such as an iPad.
- Smart Platform: Smart Platform is a technology platform that allows for capturing and publishing a versatile range of data, from audio, video and images to documents and other types of written files. The data is uploaded onto a cloud-based platform where it is time stamped and with the option to add feedback to the content. This makes the technical platform perfect for evaluate purposes in production, manufacturing and servicing a range of water system.

Smart agricultural management: The huge leap forward in connectivity that 5G will bring is set to increase the profitability, efficiency, and safety across several markets globally and many would argue, none more—so than in agriculture and farming. 5G will provide real time data in amazing ways and when used alongside

agricultural practices, the new abilities to monitor, track and automate systems in lightning-fast speed which will give rise to smart-farming.

Agricultural IoT (internet of things) devices will allow farmers to better measure things on a day-to-day basis. Things like crop communication, allowing sensors to communicate moisture, fertilization, and nutrition level as well as report on current and predicted weather patterns to allow for improvement of crops.

### 3.6 Li-Fi Technology

Li-Fi is a wireless communication technology which utilizes light to transmit data and position between devices. Li-Fi technology consists of LED lamp as the media transmission and photo-detector as a receiver of transmitted data. The rate speed of Li-Fi is 1000 times faster than Wi-Fi, as it is barrier free and can be used as a mass network system. It can be used in all the domains such as emergency, security, E-governance, industrial and agricultural services. So, we can implement in all the above domains.

## IV. RESULTS

**Civic Engagement & Digital Equality and Accessibility:** Citizen Engagement is key to smart city success. To keep pace with the changing needs of the citizens, and the development of new business, cities are now striving to become not just smart but also innovative. Machine learning and chat bots are being used to engage citizens or assets with their environment.

“As data analytics and insights become increasingly valuable because of the extensive analytics and learning, data algorithms will become the essential element to create user-focused services.”

“Changes in citizen mind sets mean that governments must change their mind sets. Government CIOs today need to look at creating innovation strategies to attract new industries and develop digital skills. They need to look at changing their spatial planning, road infrastructure, data and service management.”

With digital equality and accessibility, we will be benefitted of universal access of internet and other facilities by making it accessible to irrespective of one's status in society be it economical (rich or poor), political, social or religious etc.

**Transportation and Smart mobility:** The smart urban mobility solutions offers a multimodal capacity which bundles transport option such as public transport, on-demand services, vehicle sharing and ride hailing. With access to some transport app, customers can book and pay for mobility services through personal integrated account.

A smart transportation network is clean and efficient. Reduced traffic congestion results in cleaner air, less wasted time and reduced energy consumption. And cities that are working to accommodate electric and eventually, autonomous connected vehicles can expect to realize even greater environmental benefits.

With Intelligent Traffic System (ITS) aims to achieve traffic efficiency by minimizing traffic problems, local convenience real-time running information, seat availability etc. which reduces travel time of commuters as well as their safety and comfort.

**Tourism, arts, libraries, culture, open spaces:** With smart accessibilities we also accommodate for tourism, art and cultural societies, adequate libraries and E-book centres or facilities and stadiums, parks and playing grounds with smart facilities and easy accessibilities in the Smart City.

## V. CONCLUSION

The purpose of the Smart Cities Mission is to drive economic growth and improve the quality of life of people by enabling local area development and harnessing advanced technology that leads to SMART outcomes. Area-based development will transform existing areas (retrofit and redeveloped), including slums into better planned ones, thereby improving liveability of the whole city. New areas (Greenfield) will be developed around cities in order to accommodate the expanding population in urban areas. Application of Smart solutions will enable cities to use technology, information, and data to improve infrastructure and services with well-developed eco-system. Comprehensive development in this way will improve quality of life, create employment and enhance incomes for all, especially the poor and the disadvantaged, leading to inclusive cities.

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