

Planning and Design Challenges of Smart Cities

^[1] Ar. Mrunal Gaikwad, ^[2] Ar. Saurabh Paliwal, ^[3] Ar. Nikhil Wasade

^[1]Assistant Professor, ^[2] & ^[3] Associate Professor,
Priyadarshini Institute of Architecture and Design Studies, Nagpur

Abstract:— Smart city program is a motivated project of Government of India. It aims to facilitate the latest smart technology and infrastructure in our cities. As such, there is no universally accepted definition of a smart city. The concept of smart city varies from place to place and city to city depending on the level of development, willingness to change and reform, adapt & innovate, resources and aspirations of the city residents. There is a lot of migration from rural areas to cities, due to lack of educational facilities, economic & employment opportunities and a good quality of life. However, due to rapid urbanization the existing cities are becoming unlivable and unable to cope with increasing pressure on existing infrastructure, and the smart city concept offers opportunities to rise to these planning and designing challenges, solve urban problems and provide a decent quality of life to its citizens. These cities would take advantage of technology for offering more planned and generous living environment for its citizens with a smart physical, social, institutional and economic infrastructure. This paper addresses the basic Planning and Design Challenges of Smart Cities with its component and applicability in areas based infrastructure development.

Keywords:----- Smart city, Urbanization, Area based Infrastructure, Challenges.

I. INTRODUCTION

As such, there is no universally accepted definition of a smart city. The concept of smart city varies from place to place and city to city depending on the level of development, willingness to change and reform, to adapt & innovate, resources and aspirations of the city residents.



Fig.1. Core infrastructure elements in a Smart city

However, there are some Basic requirements for a smart city as follows:

- A Smart City must provide basic infrastructure in terms of good quality but affordable housing, cost efficient physical infrastructure such as 24 x 7 water supply, sanitation, 24 x 7 electric supply, clean air, quality education, health care,

security, entertainment, sports, robust and high speed interconnectivity, fast & efficient urban mobility etc.

- It needs to support the traditional or family based skills to develop required environment for creation of economic activities and employment opportunities.

- A Smart City needs to identify its comparative or unique advantage and core competence in specific areas of economic activities and promote such activities aggressively, by developing the required institutional, physical, social and economic infrastructures.

- A smart city should be able to provide a better Quality of

Life to its citizens, which includes safety and security for women, children and the elderly, inclusiveness, entertainment, access to public utilities, cost efficient healthcare, quality education, transparency, accountability and opportunities for participation in governance.

- A smart city uses 'smart' solutions to make infrastructure and services better

II. GUIDELINES FOR DEVELOPING SMART CITIES

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 technology, especially technology that leads to Smart outcomes. Area-based development will transform existing areas in to organized area with retrofitting and

redevelopment, thereby improving livability of the whole City. However, there are some basic guidelines for developing smart city as follows:

2.1. High quality streets and public spaces: Well-planned streets and public spaces that shape the urban structure help support local economy, connectivity, culture, creativity, and future developments. A decent road system functions well for vehicles and public transport as well as for pedestrians and cyclists, at least half of the land to be used for public space, 30% to be allocated to streets for building well connected grids and 20% to squares, parks and open spaces.

2.2. Mixed Urban Uses and limited land-use specialization: Mixed land-use planning helps create employment opportunities in local areas, promote the local economy, reduce car dependency and commute, encourage pedestrian, cyclist and other non-motorised transport, reduce landscape fragmentation and green-house gas emissions, provide closer public services, support mixed communities and local economies, promote safer communities and create attractive neighborhoods.

2.3. Connectivity: The purpose behind expanding connectivity is to create access to jobs and services for all and to boost local economies. This encourages walking, cycling, public transport, and information & technology accessibility for all.

2.4. Waste management: Waste collection modeling and consistent supply to energy generation to be considered at area based development.

2.5. Mixed social structure: This principle aims to promote cohesion and interaction between different social classes in

the same neighbourhood and ensuring accessibility to equitable urban opportunities by providing different types of housing.

2.6. Energy and Resource Efficiency: By utilizing existing resources in a sustainable manner, assisted by smart technologies cities can minimize impacts on the

environment and be responsive to the needs of the poor and vulnerable.

2.7. Practical and enforceable norms and rules: To adapt up with the fast urban growth that cities are experiencing, it is critical to provide policies, plans, norms and rules that respond to the current needs of municipalities and should be locality based. The guidelines, norms and rules should be developed with a participatory approach based on the principles of equity and social cohesion through public participation modules.

III. AREA BASED DEVELOPMENT OF SMART CITIES

There are mainly three models of Area-based development of Smart Cities, which included City improvement (retrofitting), City renewal (redevelopment) and City extension (Greenfield development)

Models of Area Based Development for Smart Cities can be executed in the following three Categories:

A) Retrofitting: Development of an existing built area greater than 500 acres to achieve the objective of smart cities mission to make it more efficient and livable. Depending on the existing level of infrastructure services in the identified area and the vision of the residents, the cities will prepare a strategy to become smart. Since existing structures in this model are to remain intact, more intensive infrastructure service levels and a large number of smart applications will pack in this.

B) Redevelopment: Replace existing built environment in an area of more than 50 acres and enable co-creation of a new layout, especially enhanced infrastructure, mixed land use and increased density. A new layout plan of the identified area will be prepared with mixed land-use, higher FSI and high ground coverage between the consumer and water service provider is achievable. This leads to reduction in transaction costs for water payment as well as administrative costs, which consequently increases revenues for water utilities.

C) Greenfield developments: Develop a previously vacant area of more than 250 acres using innovative planning, plan financing and plan implementation tools with provision for

affordable housing, especially for the poor. These are required around cities in order to address the needs of the expanding population, located either within the limits of the Urban Local Bodies (ULB) or within the limits of the local Urban Development Authority (UDA).

The above models get support with Pan-city initiative in which Smart Solutions apply over larger parts of the city. Pan-city development envisages application of selected Smart Solutions to the existing citywide infrastructure. Application of Smart Solutions will involve the use of technology, information and data to make infrastructure and services better.

IV AREA BASED PLANNING AND DESIGN CHALLENGES OF SMART CITIES

The concept of smart cities is to have a holistic approach towards transformation and development of existing and new areas to make them economically viable, socially equitable and environmentally sustainable. The Comprehensive development of smart cities should promote the following:

- Mixed land use in area-based developments while enabling flexibility in land use and building bye-laws to adapt to change
- Pedestrian friendly and non-motorized vehicles routes with walk able localities, reducing congestion, air pollution and resource depletion, boost local economy, promote interactions and ensure security. These routes are also a key to the success of any public mass transit system
- Preserving and developing open spaces like parks, playgrounds, and recreational areas in order to enhance the quality of life of citizens, reducing the urban heat effects in Areas and generally promote eco-balance
- Promoting a variety of transport options Transit Oriented

Development (TOD), public transport and last mile Para-transport connectivity.

- Enabling citizen-friendly institutional governance increasingly rely on online services to bring about accountability and transparency.

- Giving an individual identity to the city based on its main economic activity, skills or heritage etc.

- Applying Smart Solutions to infrastructure and services in area-based development in order to make them better and reduction in overall maintains cost like Area based sewage disposal system to reduce the transportation infrastructure requirement at city level.

Overall the basic challenges of smart city planning are as follows:

- Assured electricity supply with at least 10% of the Smart City's energy requirement coming from renewable energy sources
- Adequate water supply including waste water recycling and storm water reuse, Sanitation including solid waste management, rain water harvesting,
- There are various latent issues to consider when reviewing a smart city strategy. The most essential is to determine the existing city's weak areas that need utmost consideration, e.g.

100% distribution of water supply and sanitation. The integration of formerly isolated legacy systems to achieve citywide efficiencies can be a significant challenge.

- Pedestrian friendly pathways, encouragement non-motorized transport, intelligent traffic management, no-vehicle zones, smart parking, and energy efficient street lighting,

- Innovative use of open spaces, underground wiring,

encroachment-free public areas, and ensuring safety of citizens especially children, women and elderly.

- At least 80% buildings should be energy efficient and green buildings.
- At least 15% of the housing shall be in the affordable housing category.

V. CONCLUSION

In India, administration in the cities are often confronted with a multitude of key problems, like unplanned development, informal real estate markets, inevitable population growth, lack of infrastructure, inadequate transport facilities, traffic congestion, poor power supply, in competent health services, and lack of basic services both within the city and in the suburban areas, poor natural hazards management in overpopulated areas, crime, water, soil and air pollution

leading to environmental degradation, climate change and poor governance arrangements are leading the urban citizen life in unhappy. So it is the need of the hour to plan and build the smart cities in view of resolving these problems.

Smart city is not a new concept and have been followed globally to improve the quality of living and promote operational efficiency and productivity of the cities. It is an attempt to make cities more livable, sustainable and for creating a brand image to attract investment and generate ROI (returns on investment). Globally, smart cities are characterizing by high degree of environmental consciousness using information technology to promote energy/resource efficiency, creation for knowledge infrastructure, promoting sustainable economic development and high quality of life, insuring wise management of natural resources through participatory action.

A city can be smart only if it is planned smart, developed smart, operated smart, finance smart and governed smart.

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