

Smart City–A Renaissance

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Abstract—The idea of smart city has been a major concern for these days as is evident from Narendra Modi's proposal of rejuvenating 100 smart cities across India. Our paper is an overview of the outlook of the smart cities along with inculcation of smart solutions to almost every spheres of livelihood. Now the question is how will the smart cities of future India be? How to ensure proper food, health facilities & shelter to all? How will be its education system? How can its environment be pollution free? How will be its transportation & communication system? How will be its economic backbone & employment opportunities? How can its optimization in resources & energies be achieved? How can its development & technological advancement be put forth? How will be its city planning & administration? What will be its agricultural & industrial throughput? The paper basically reflects salient features allied to a smart city.

Historical Background: Designing/planning of smart city has been at bay since the early history as is evident from some of the renowned well-planned cities namely Vedic cities of UJJAIN, PATALIPUTRA (ancient capital of Magadha) as per Vedic architecture; HARAPPA & MOHENJODARO are another well-equipped cities, built 4600 years ago in Indo-Pakistan regions with LOTHAL, as one of the flourished sea port. Streets were straight then with 90 degree curve along with well-planned sanitation & planned bathing pool.

Meanwhile, Jaipur is considered to be the first well planned city of India, presently, prior to its pink architectural view.

Keywords: Smart city-sophisticated features; flexibility & easiness in livelihood; autonomous intelligent infrastructure & integrated smart functioning; world class health facilities; tested food & quality-monitored water; world class education; genuine administration & city planning; Industrial automation & productivity enhancement; multi-modal transportation facilities; smart security; Information technology; citizen-governance interface

1. INTRODUCTION

Smart city, in a nutshell, encompasses a wish list of infrastructure and services describing a certain level of aspiration, needs of the citizens which is accomplished by an entire urban ecosystem comprising of four pillars of incremental comprehensive development-institutional,

physical, social and economic infrastructure rendering a decent quality of life to its citizens, a clean and sustainable environment, and acting as a replicable model that will act like a light house to other aspiring cities. The conceptualization of Smart City varies from city to city and country to country, depending on the level of development, willingness to change and reform, resources and aspirations of the city residents. The core infrastructure elements in a smart city would include:

1. Adequate water supply,
2. Assured electricity supply,
3. Sanitation, including solid waste management,
4. Efficient urban mobility and public transport,
5. Affordable housing, especially for the poor,
6. Robust IT connectivity and digitalization,
7. Good governance, especially e-Governance and citizen participation,
8. Sustainable environment,
9. Safety and security of citizens, particularly women, children and the elderly, and
10. Health and education.

Our research paper thoroughly anneals some of the smart solutions to envisage exuberance & pliability in its smart city which are enlisted as follows:

- 1) **E-Governance & Citizen services:**
 - a) Public information & grievance redressal
 - b) Electronic service delivery
 - c) Citizen engagement
 - d) Citizens-city's eyes & ears
 - e) Video crime monitoring
- 2) **Energy, water & waste management:**
 - a) Waste to compost, energy & fuel

- b) Recycling & reduction of C&D waste, treatment of waste water
 - c) Smart meters & management
 - d) Leakage identification, preventive maint
 - e) Water quality monitoring
 - f) Renewable sources of energy
 - g) Energy efficient & Green buildings
- 3) Urban mobility:**
- a) Smart parking
 - b) Intelligent traffic management
 - c) Integrated multi-modal transportation
- 4) Others:**
- d) Tele- Medicine & Tele Education
 - e) Incubation/trade facilitation centres
 - f) Skill development centres

As far as Smart Solutions are concerned, these are not, however, an exhaustive list, and cities are free to add more application.

SYSTEMATIC LAND CONFIGURATION:

- 1) Accordingly, 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.
- 2) Area- based development will transform existing areas (retrofit and redevelop), including slums, into better planned ones, thereby improving livability of the whole City.
- 3) New areas (greenfield) will be developed around cities in order to accommodate the expanding population in urban areas.
- 4) Application of Smart Solutions will enable cities to use technology, information and data to improve infrastructure and services.
- 5) 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.

Some distinctive attributes of a smart city would include:

1) HEALTH :

- a) World class hospitality including (24 x 7) ambulance facility, modern treatment process involving digital testing & diagnosis, robotic surgery like laparoscopy, microchips modeling clinical trials, optogenetics, uses of digestible sensors, etc.
- b) Establishment of ample licensed blood donation camps, free healthcare centres for the underprivileged, and recreational hubs encouraging practice of exercises & Yogas & nurturing harmonic ambience.

2) FOOD:

- a) Providing quality food items by eliminating adulterations.
- b) Uses of harmful chemical fertilizers like DDT, and pesticides should be compromised with natural manures in cultivation, wherever possible.
- c) Industrially manufactured food items should be monitored on regular basis before being marketed.
- d) Harvesting & consumption of seasonal food items such as fruits, vegetables should be encouraged.

3) EDUCATION:

- a) *World class education system (research based & not exam specific) conglomerating e-learning, digi-labs, multimedia classes, digital libraries.*
Merits: Effective simulation in each & every student's mind right from the grass-root level as proper education is the 1st step towards framing a smart city.

Visualization through innovation is more effective than mere conventional theoretical approach.

- b) *Elucidation of theories & smart conceptualization should be carried out through videos, animations, graphical-oriented explanations, still images, intellectual gaming approach, etc.*
- c) *Emphasis on techno cultural sports activities.*
- d) *Environmental science has to be made compulsory at every schools & colleges*
- e) *Sex education at secondary/senior-secondary levels of school.*
- f) *Well-equipped R&D cells almost in every educational institutes*
- g) *A centralized R&D cell that should exhibit a strong network with each & every nodal R&D cells.*

4) WATER SUPPLY:

- a) Monitoring the purity of water with advanced filtration techniques(pH adjustment, coagulation & flocculation, sedimentation & sludge treatment, floc blanket clarifiers, membrane filtration, chlorination, ozone & ultra violet disinfection, reverse osmosis)
- b) Installation of digital meters & billing system to regulate the consumption of water.

5) POLLUTION CONTROL:

➤ AIR POLLUTION:

- a) Harnessing of greenery & fertility by adopting afforestation & systematic land utilization
- I. *Imposal of mandatory gardenings in every residential complexes, malls, industrial zones, official buildings with proper configuration.*
- II. *Plantations in the divider of roadways*
- III. *Eco-clubs in almost every sectors of the city*

b) Elimination of carbon emission & thermal energy by adopting sustainable development & ecofriendly initiatives viz.

- I. Uses of alternative fuels like biodiesel, biogas, and hydrogen fuel as substitutes for fossil fuels.
- II. Vermi - composting
- III. Installation of solar panel in rooftops of railway stations, airports, terminuses, stadiums, houses, & preferably in desert areas as an alternate source of powerhouse.
- IV. Establishment of hydro-project & nuclear power plants, wherever possible
- V. Setting up of wind mills especially in coastal region

➤ **WATER POLLUTION:**

- (a) Laying out of proper underground drainage systems, both sewerage & sullage outlets, being separated, & subsequent disposal to prevent breeding of germs.
- (b) Recycling of sullage water followed by proper treatments & making it usable for agricultural purposes
- (c) Rainwater harvesting
- (d) Purification of industrial water by osmotic treatments & ultra violet disinfectants before discharging it off, & reusing it as per applicability

➤ **NOISE POLLUTION:**

- a) Replacement of electric horns in vehicles with air horns that would blow within a tolerable range of frequency.

➤ **EM POLLUTION:**

- b) To reduce Electro-magnetic field network in cities, which are usually harmful for human being as well as city ecosystem, homes are connected by high speed optical fiber network.

6) DISASTER MANAGEMENT:

- c) *Flood Control: Cities locate on river bank should take precautionary steps to control overflow of river and soil erosion. Dams should be constructed before the city in upstream to control the flow of water and divert the flow if necessary. Cities will be built on sufficient altitude from the flood prone water level. River side should be properly embanked to prevent land erosion.*
- d) *Draught: Rain water harvesting in canals across the city can be helpful during water crisis.*
- e) *Storm: Massive gardening in and around the city can stop or reduce invasive wind speed.*
- f) *A ready action team will always be present with boats, drones and water tanker to provide help during crisis.*

g) *Mitigation on Earthquake: Emphasis on construction of earthquake-resisting structures such as installation of isolated bearings near the footings of structures, cross-bracing in reinforcing walls using 2 steel beams, shock absorbers(base isolators), shear walls(concrete walls with steel bracing in them) to reduce rocking movement.*

7) TRANSPORTATION FACILITIES & COMMUNICATIONS:

- a) *Broadening of railway networks- both mono & circular means entire coverage by metro through underground & viaduct to optimize private car ownerships & thereby reducing traffic flow on roadways.*
- b) *Expansion of lanes & improved signal system to make transportation faster & flexible.*
- c) *Smart Maglev train with inertial mapping system can run according to clock pulse set for every station, by which every train will reach and leave station automatically on time allotted for that particular station. A Central Control Unit will adjust the speed if there exist any emergency delay. Busy hours will be adjusted by increasing the mobility of train.*
- d) *In Streets only electric vehicle will be permitted to run. Charging station should be placed at every key point in the city. There should be a lane for automated cars in all important roads. Automated cars will be guided by integration of inertial mapping, obstacle avoiding and road mapping. Smart traffic signaling system will also provide instruction to the cars if further guidance is required. Installation of buffer system in speed breakers across roads with internal mechanical arrangement that would rotate shaft to generate electricity on streets.*
- e) *Integrated ultra-smart metro stations with automated metal detectors, sensors & scanners for ensuring security, automated floor-to-ceiling sliding door type system(preferably of fibres or considerably high quality glass) retrofitted near the edges of each & every platforms in metro stations that would screen the platform from the train & thereby preventing accidental falls off the platform onto the lower track areas, suicidal attempts, homicides by pushing, improving the climate control within the station(heating, ventilation, and air conditioning are more effective when the station is physically isolated from the tunnel), improving security-access to the tracks and tunnels is restricted, preventing litter build up on the track and fire risk. The platform shielding doors is installed in such a way, so that it can scan the sliding doors of the trains, when it halts, automatically(adjacent transmitter-receiver signaling system)& would undergo operation after subsequent processing.*

- f) A special coach for the provision of prompt ambulance facility in every train.
- g) The city is scudded with a strong network of subways, footpaths & footbridges for enabling smooth pedestrian
- h) At every junction/confluence of road there will be placed digital display mapping guide. There pedestrian as well as driver will get the current location as well as guide to reach destination within the city. They will provide direction as well as traffic rules to reach a place. We can also add display boards to provide people with latest news as well as events happening around the globe like Technological innovation, Sports and Cultural events. This will keep people updated while in restaurant, parks and travelling.
- i) Automated Bascule Bridge is constructed over certain water bodies to enhance convenient traffic flow of ships. The bridge with an intelligent traffic system in it will automatically detect an approaching ship which is of considerable height & would pop-up its structural flange automatically prior to a motor cum counter-weight arrangement.
- j) Every sector will have lighting displaying color code as well as symbols of that particular sector or block. This will make travelling much user friendly.

8) INFORMATION TECHNOLOGY AND POWER SUPPLY:

a) *Digital communication system*

- I. *Optical fibers for communication & Wi-Fi router*
- II. *Full & free Wi-Fi city*

b) *Proper synchronization: Installation of underground tunnel & nested sub-casing systems through which entire network of wirings will be laid out in a segmented manner and it comprises of:*

- I. *Copper lines for power supply to houses*
- II. *Optical fibers*
- III. *LAN connection line*
- IV. *Tele-communication cable*

c) *Merits of synchronization:*

- I. *Interpretation of faults, failures or leakages can easily be checked by applying requisite potential drop across the target node.*
- II. *Obliteration of electromagnetic pollution, i.e. uncongenial radiations is well accomplished owing to an utter underground system of signal transmission.*

9) ECONOMY & EMPLOYMENT:

- I. *Incorporation of automation in manufacturing process yielding more productivity with optimal investment resulting in gross revenue enhancement*
- II. *Flourished agro based industries*
- III. *Lesser economic disparity among the masses*

- IV. *Full-fledged financial collaboration along with re-engineering*
- V. *Prioritization on automation in almost every socio-economic fragment will tremendously maximize the need for skilled laborers, technicians & workers & thereby nurturing employment.*

10) CITY MAINTENANCE & CLEANLINESS:

- a) Laying out of integrated network of smart underground gas transmission lines for pliable supply to the customers accompanied with installation of digital meters & regulators that would monitor/regulate the consumption of gases.
- b) There will be Waste sweeping vehicles to collect dust and other scattered waste at one point per street.
- c) The waste sweeping vehicle will be parked in Cleaner garage, the garage will provide power and signal to waste sweeping vehicle.
- d) The waste sweeping vehicle will have coded instruction and mapping of its permitted cleaning zone, further it will have image processor to avoid obstacle and guiding compass for direction. It will return to its base cleaner's garage after completion of task.
- e) We can give two tier flooring system to all streets in the city, where underground flooring can act as tunnel under the street, it can act as a medium for electricity, information, and water supply.
- f) Waste can be transported in underground rail dustbin on narrow rail track, there will be separate dustbin for solid and liquid, they will collect waste from waste point located above on surface.

11) ADMINISTRATION & CITIZEN-GOVERNANCE INTERFACE:

a) **E-citizenship card:**

- i. An issuance of a mandatory digital central card to each & every citizens which would contain an embedded system of credentials such as scanned eye-retina, thumb-prints, VOTER card no., PAN card no. & ADHAR no. & a chip with an unique identification no. being slotted to store bank oriented details so that the concerned authority can keep track of each & every citizens, i.e. his/her transactional updates
- ii. All payments viz. electric bills, telephone bills, gas bills along with opening/renewal/closing of accounts have to be disbursed via online in customized websites using the unique identification no. of the chip
- iii. The income tax department shall have full access to this e-citizenship card & can execute legal monitoring/auto-deductions from the saving account of the citizen, if necessary; this would prevent catastrophic black money, corruption & would ensure a complete economical equilibrium.

- iv. An absolute centralization on every public entities, viz transportation system, banking, industries, etc.

12) INDUSTRIAL AUTOMATION:

- a) Automation in conveyor belt operation & assembly line
- b) Systematic chemical processing & subsequent assemblance in automated mechanical throughput.
- c) Entire Assembly line up should have automated manufacturing
- d) Waste product should be classified before decomposition.
- e) Harmful substance in waste should be eliminated before release.
- f) It will take multiple input and process for output.

13) SECURITY SYSTEM

- a) There should be vigilance cameras (CCTV footage technologies) throughout the city that would be monitored by a central control unit, configured amidst city.
- b) Autonomous provision of cops in land, water & air.
- c) Drone system installed with semi-automated guns (containing anesthetic bullets) & camera system, programmed in such a way so that it can operate automatically within an assigned zone frame.
- d) Areas will be segregated on the basis of their installed cluster of camera that would undergo an intelligent coordination with the central control unit.
- e) Cars will be checked by x-ray radiation if required for security.
- f) There will be chemical sensors inside the tunnel to detect any leakage in pipeline. If any leakage is detected in the tunnel then immediately a repairing team will reach on spot.

- g) Human activities inside the tunnel will be prohibited. Thermal sensor will detect any illegal human activities inside the tunnel if detected a robotic team of hexapod will reach on spot to manage crime crisis.

2. CONCLUSION

From this paper we tried to describe the features that we should target to build our smart city project. We should research more in Field of computation and setting the city in respect to clock pulse suitable for city life. Bringing automation in the field of Construction we should be approaching in future. The city which can be intelligent enough to take logical decision and make life more flamboyant & exuberant for citizen. People of future will probably have to put less labor in life.

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