IIT KHARAGPUR

NPTEL ONLINE
CERTIFICATION COURSES

Smart Cities and Smart Homes – Part I

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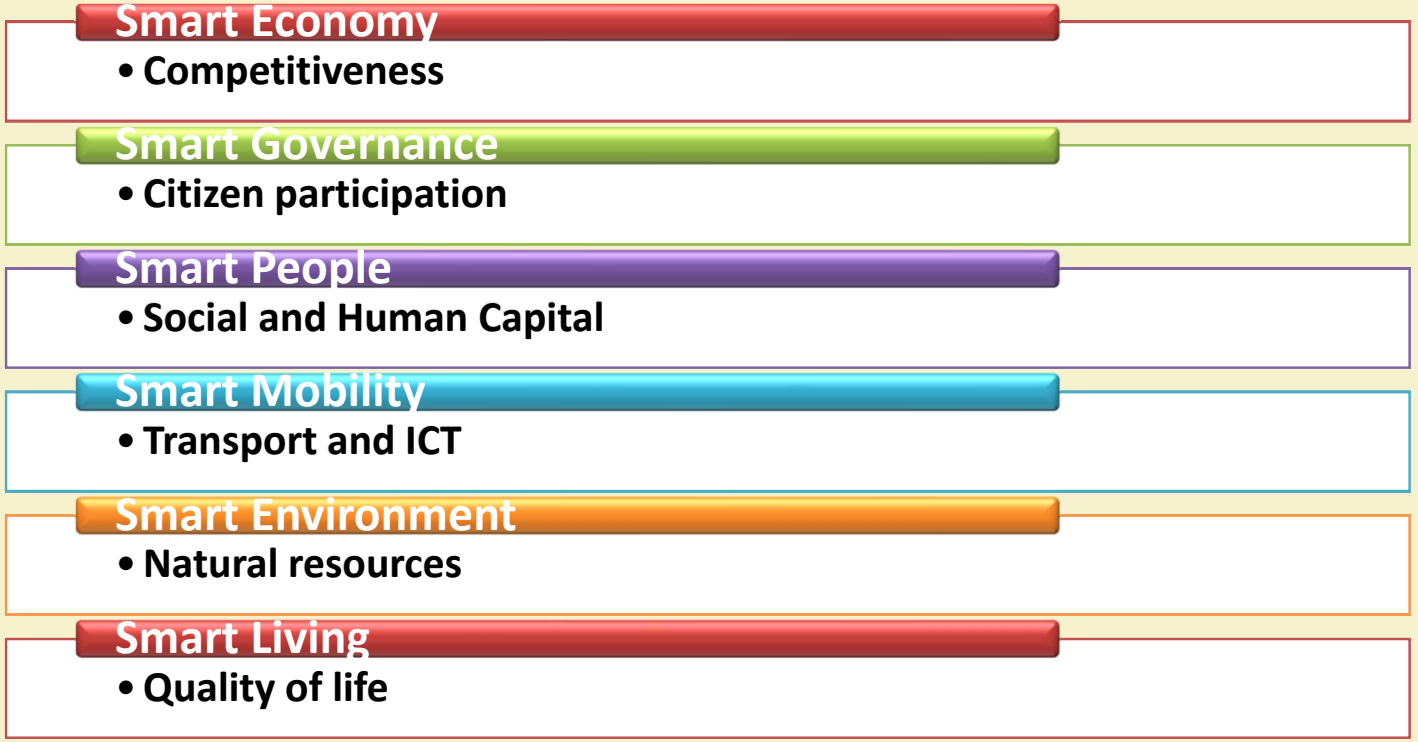
Introduction

- ✓ A Smart City is-
  - An urban system
  - Uses Information & Communication Technology (ICT)
  - Makes infrastructure more interactive, accessible and efficient.
- ✓ Need for Smart Cities arose due to-
  - Rapidly growing urban population
  - Fast depleting natural resources
  - Changes in environment and climate

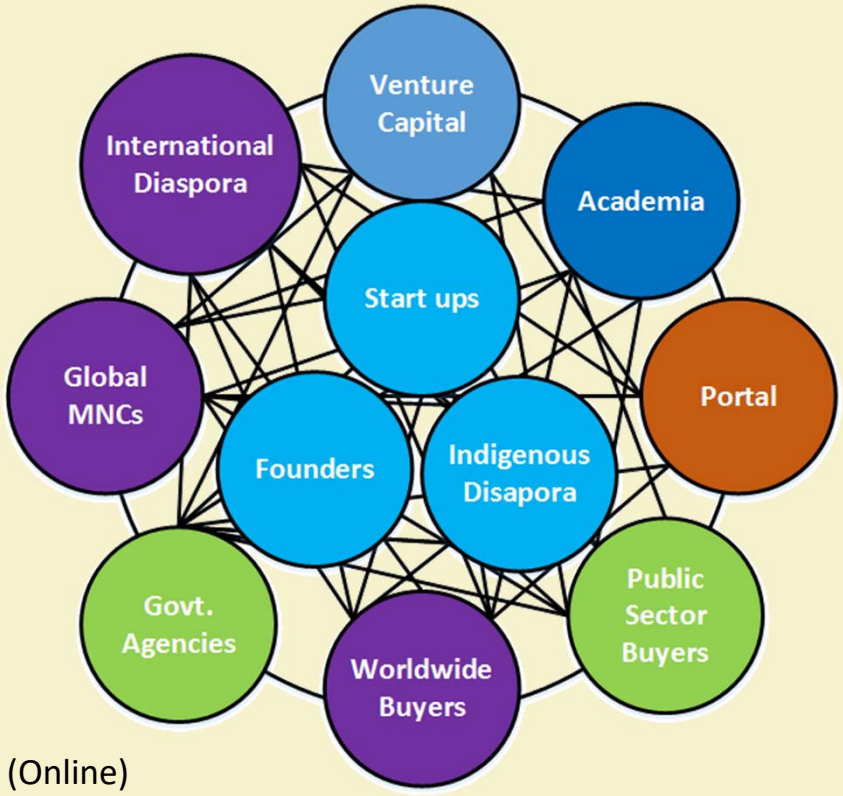
Source: Pellicer, Soledad, et al. "A global perspective of smart cities: A survey." IEEE *Seventh International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing (IMIS), 2013*.

Application Focus Areas



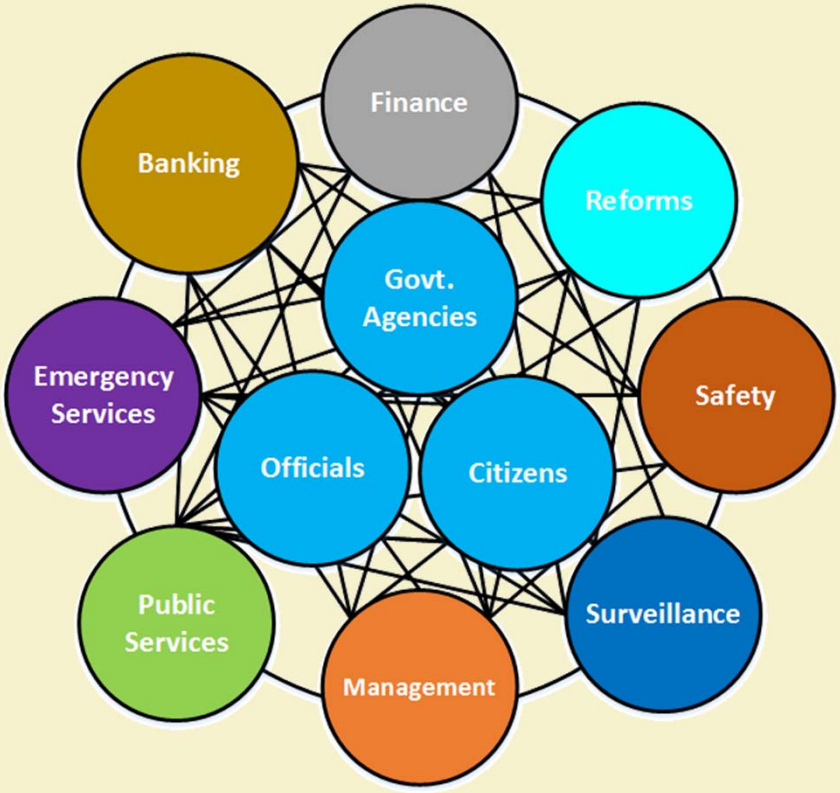
Source: Pellicer, Soledad, et al. "A global perspective of smart cities: A survey." IEEE *Seventh International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing (IMIS), 2013*.

Smart Economy

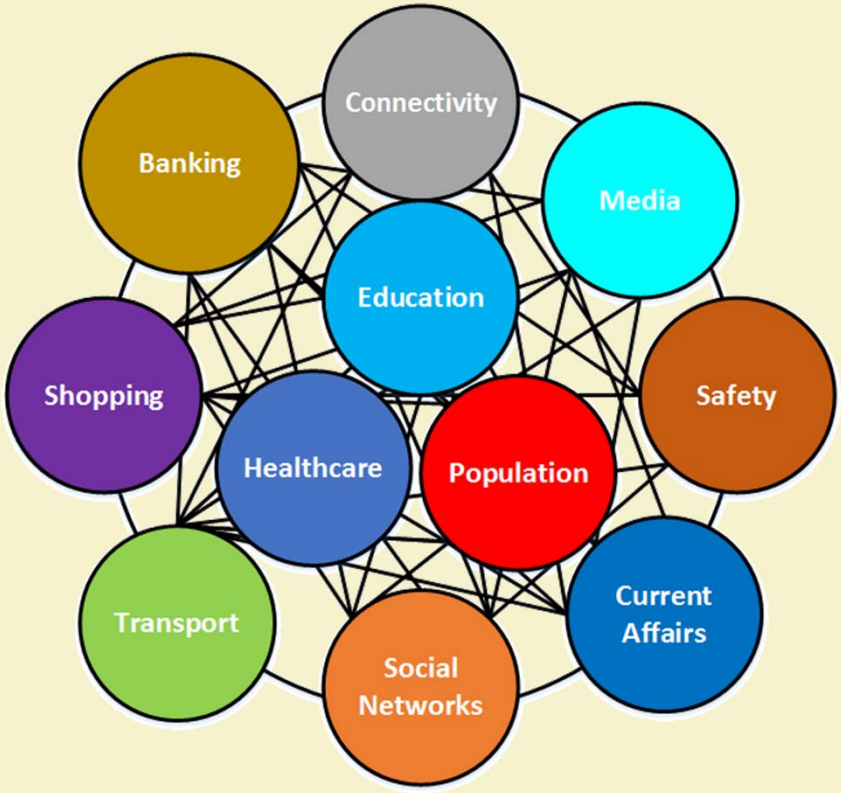


Source: "Smart Economy", Project Chapel Hill (Online)

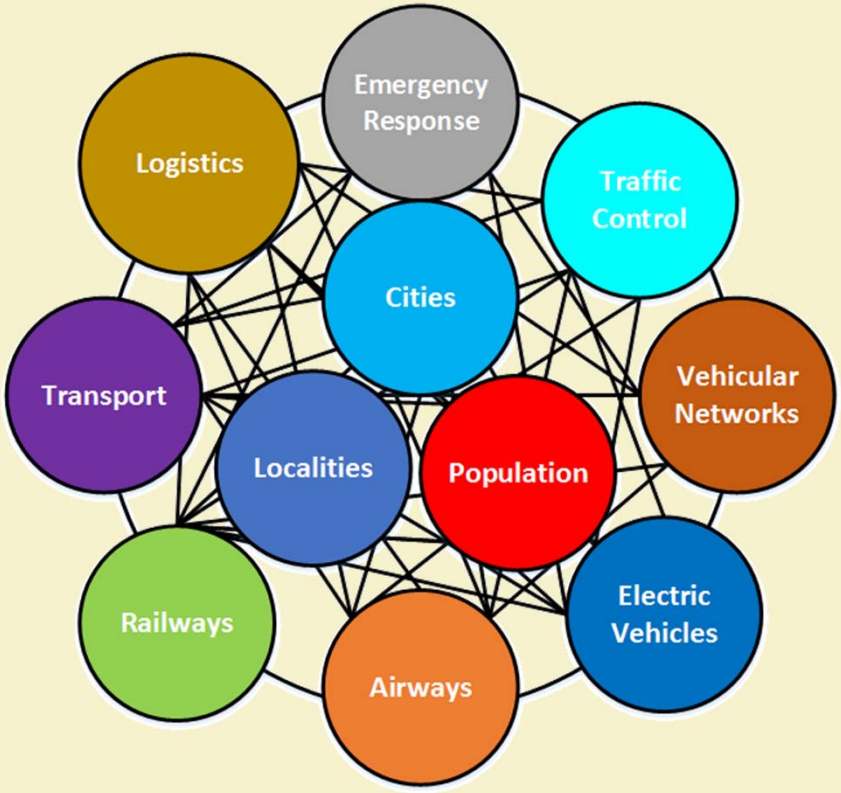
Smart Governance



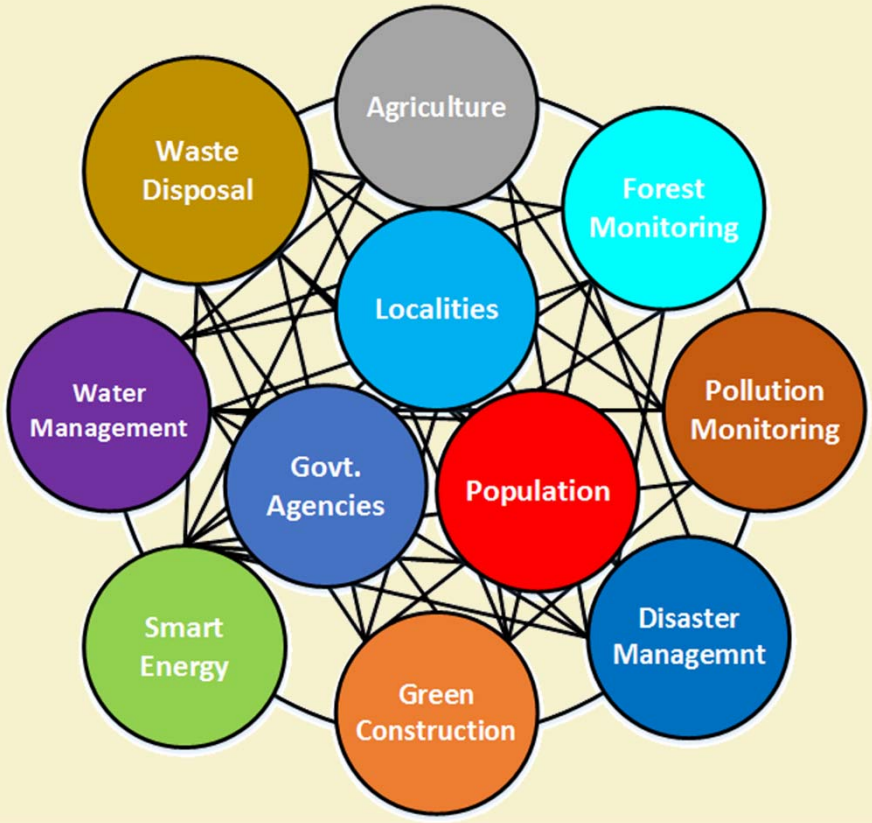
Smart People



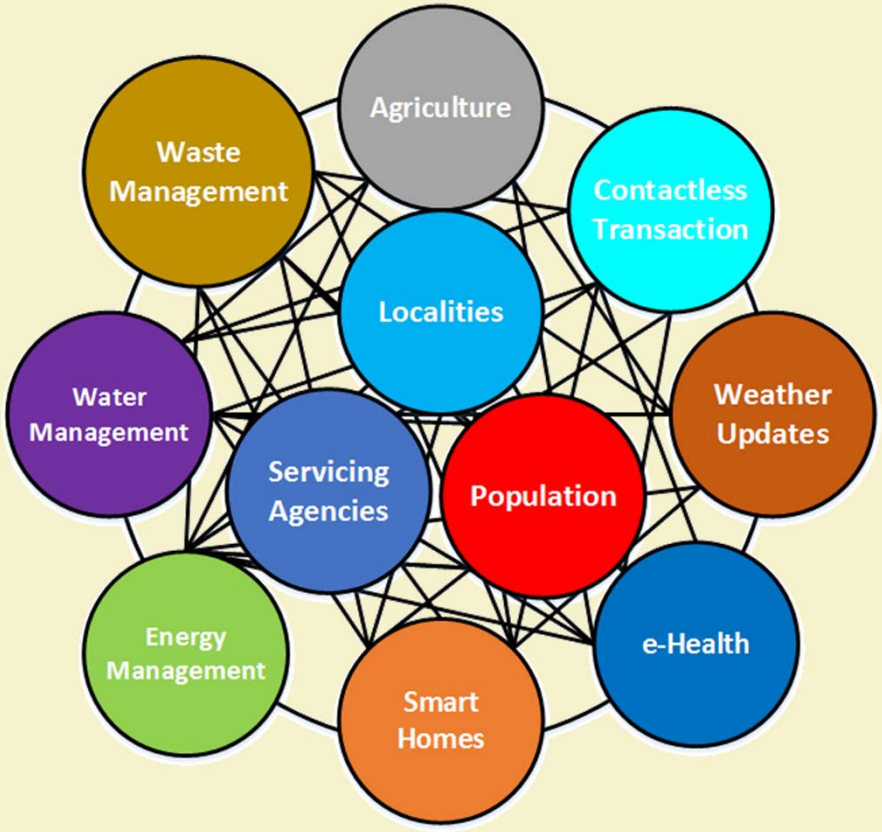
Smart Mobility



Smart Environment



Smart Living



Current Focus Areas

- ✓ Smart Homes
  - Health monitoring.
  - Conservation of resources (e.g. electricity, water, fuel).
  - Security and safety.
- ✓ Smart Parking Lots
  - Auto routing of vehicles to empty slots.
  - Auto charging for services provided.
  - Detection of vacant slots in the parking lot.

Current Focus Areas (contd.)

- ✓ Smart Vehicles
  - Assistance to drivers during bad weather or low-visibility.
  - Detection of bad driving patterns or driving under the influence of substances.
  - Auto alert generation during crashes.
  - Self diagnostics.
- ✓ Smart Health
  - Low cost, portable, at-home medical diagnosis kits.
  - Remote check-ups and diagnosis.
  - On-body sensors for effortless and accurate health monitoring.
  - Auto alert generation in case of emergency medical episodes (e.g. Heart attacks, seizures).

Current Focus Areas (contd.)

- ✓ Pollution and Calamity Monitoring
  - Monitoring for weather or man-made based calamities.
  - Alert generation in case of above-threshold pollutants in the air or water.
  - Resource reallocation and rerouting of services in the event of calamities.
- ✓ Smart Energy
  - Smart metering systems.
  - Smart energy allocation and distribution system.
  - Incorporation of traditional and renewable sources of energy in the same grid.

Current Focus Areas (contd.)

- ✓ Smart Agriculture
  - Automatic detection of plant water stress.
  - Monitoring of crop health status.
  - Auto detection of crop infection.
  - Auto application of fertilizers and pesticides.
  - Scheduling harvesting and arranging proper transfer of harvests to warehouses or markets.

Technological Focus Areas

Data Collection

- Mobile devices, Sensors, Architecture

Data Transmission

- Radios, Networking, Topologies

Data Storage

- Local storage, Data warehouses

Data Processing

- Data cleaning, Analytics, Prediction

Source: Pellicer, Soledad, et al. "A global perspective of smart cities: A survey." IEEE *Seventh International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing (IMIS), 2013*.

IoT Challenges in Smart Cities

- ✓ Security and Privacy
  - Exposure to attacks (e.g. cross-site scripting, side channel, etc.).
  - Exposure to vulnerabilities.
  - Multi-tenancy induces the risk of data leakage.
- ✓ Heterogeneity
  - Integration of varying hardware platforms and specifications.
  - Integration of different radio specifications.
  - Integration of various software platforms.
  - Accommodating varying user requirements.

Source: Arasteh, H., et al. "Iot-based smart cities: A survey." *IEEE 16th International Conference on Environment and Electrical Engineering (EEEIC), 2016*.

IoT Challenges in Smart Cities (contd.)

- ✓ Reliability
  - Unreliable communication due to vehicle mobility.
  - Device failures still significant
- ✓ Large scale
  - Delay due to large scale deployments.
  - Delay due to mobility of deployed nodes.
  - Distribution of devices can affect monitoring tasks.

Source: Arasteh, H., et al. "Iot-based smart cities: A survey." *IEEE 16th International Conference on Environment and Electrical Engineering (EEEIC), 2016*.

IoT Challenges in Smart Cities (contd.)

- ✓ Legal and Social aspects
  - Services based on user provided information may be subject to local or international laws.
  - Individual and informed consent required for using humans as data sources.
- ✓ Big data
  - Transfer, storage and maintenance of huge volumes of data is expensive.
  - Data cleaning and purification is time consuming.
  - Analytics on gigantic data volumes is processing intensive.

Source: Arasteh, H., et al. "Iot-based smart cities: A survey." *IEEE 16th International Conference on Environment and Electrical Engineering (EEEIC), 2016*.

IoT Challenges in Smart Cities (contd.)

- ✓ Sensor Networks
  - Choice of appropriate sensors for individual sensing tasks is crucial.
  - Energy planning is crucial.
  - Device placement and network architecture is important for reliable end-to-end IoT implementation.
  - Communication medium and means play an important role in seamless function of IoT in smart cities.

Source: Arasteh, H., et al. "Iot-based smart cities: A survey." *IEEE 16th International Conference on Environment and Electrical Engineering (EEEIC), 2016*.

Thank You!!