

TRANSFORMING TODAY'S CITIES INTO SMART CITIES - CHALLENGES AND OPPORTUNITIES

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CREATING THE NEXT®

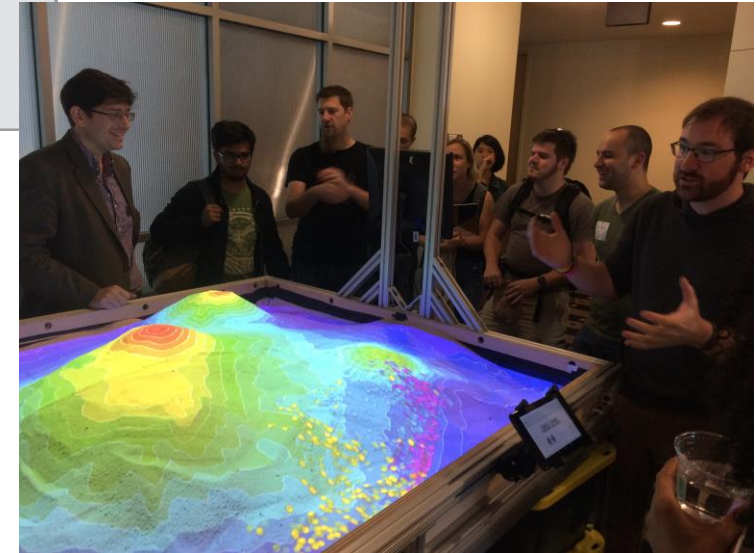


CSPAV RESEARCH FOCUS & SOME EXAMPLES

Routing Applications



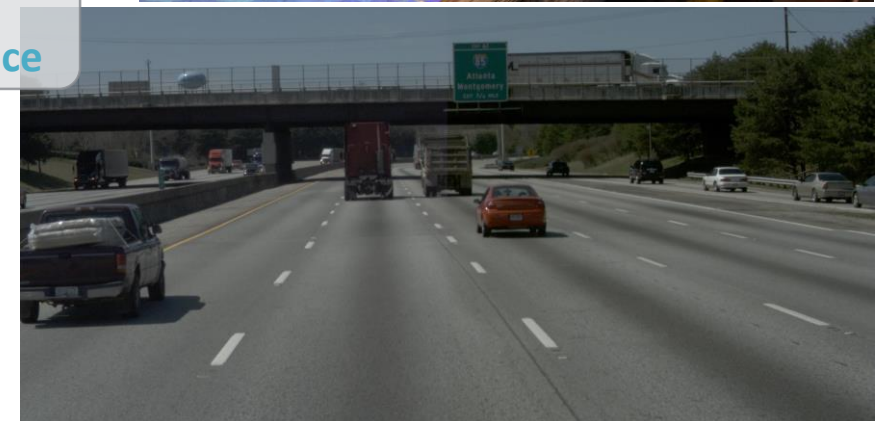
Mapping Gorilla movement in Rwanda



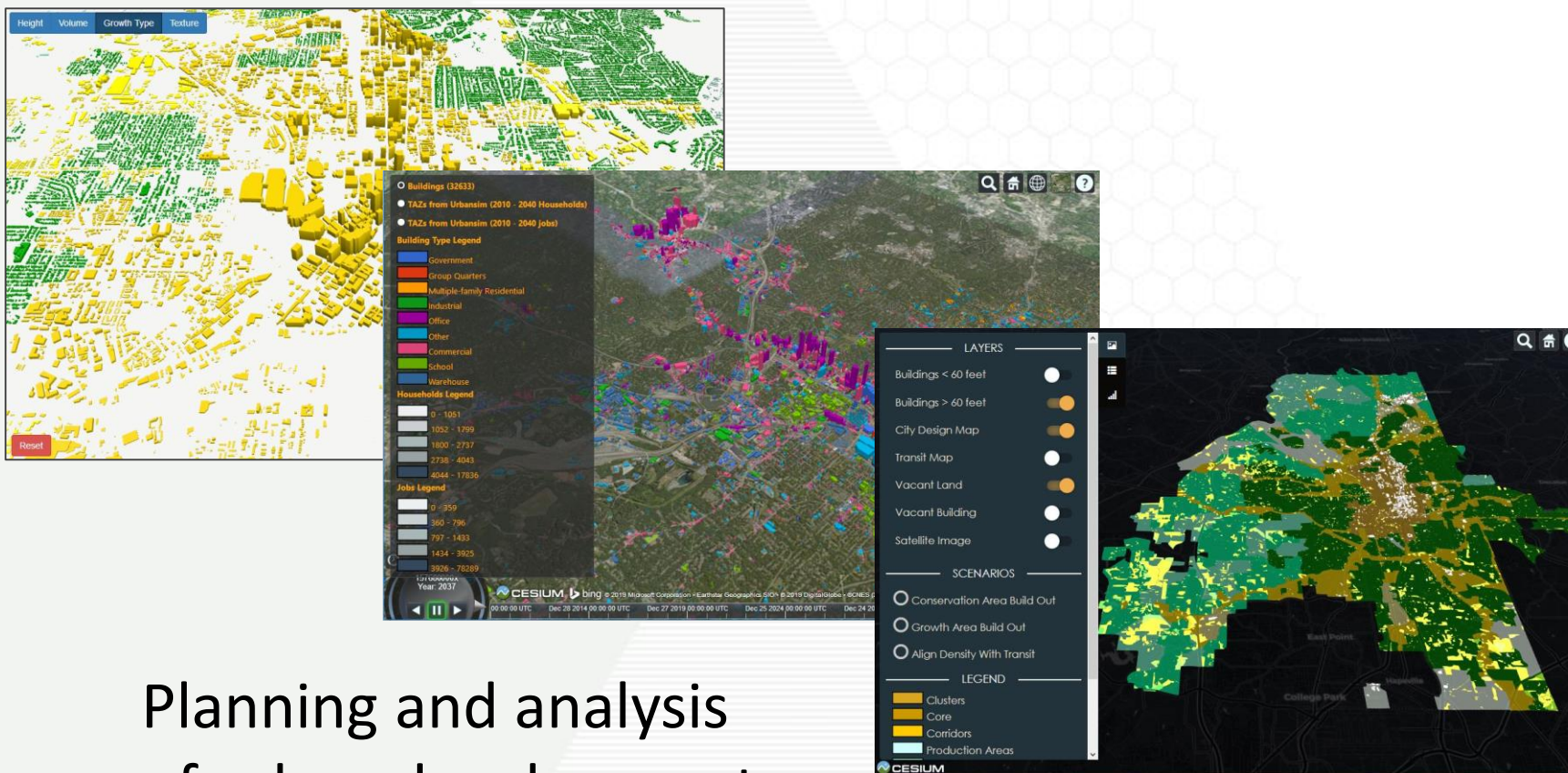
Augmented reality



Sensors for Pavement Maintenance

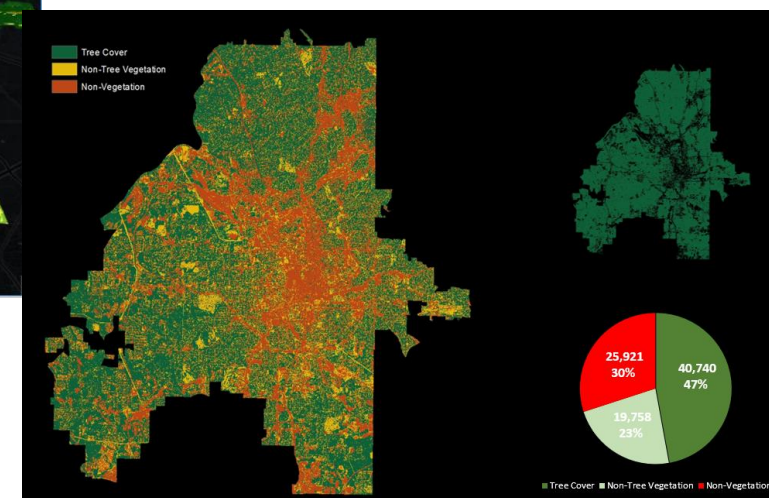


Automated detection of built environment features

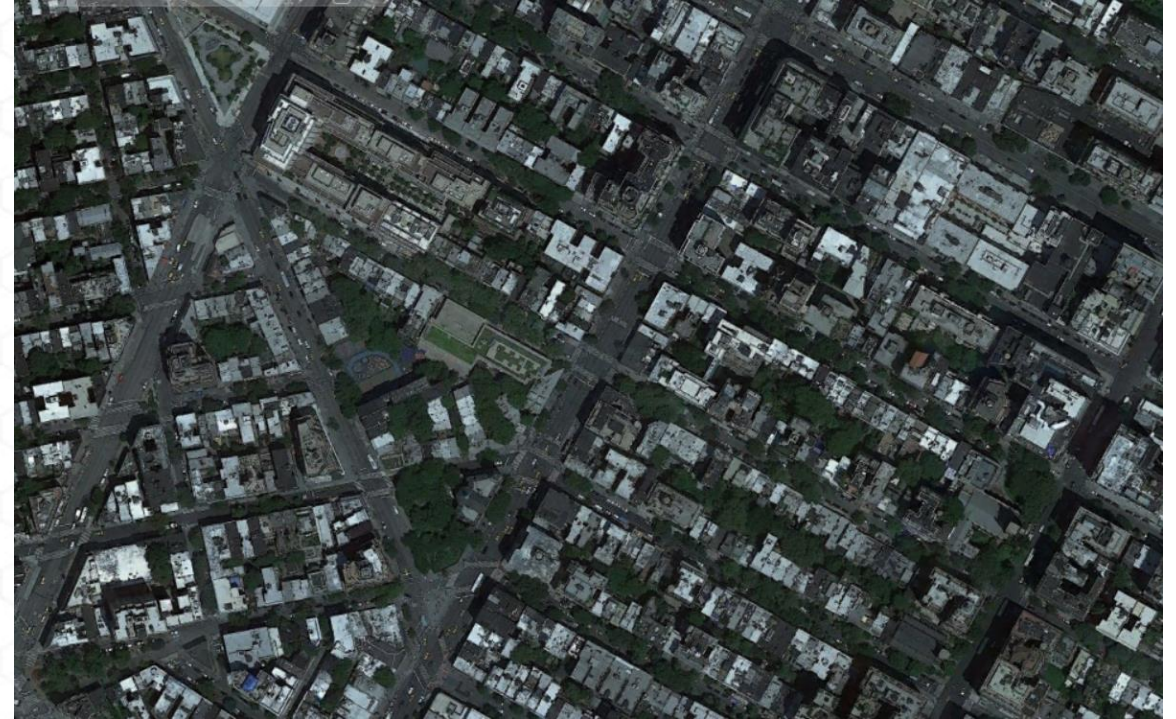


Urban Tree Canopy Assessment

Planning and analysis of urban development incorporating interactions between - land use, transportation, and the environment.

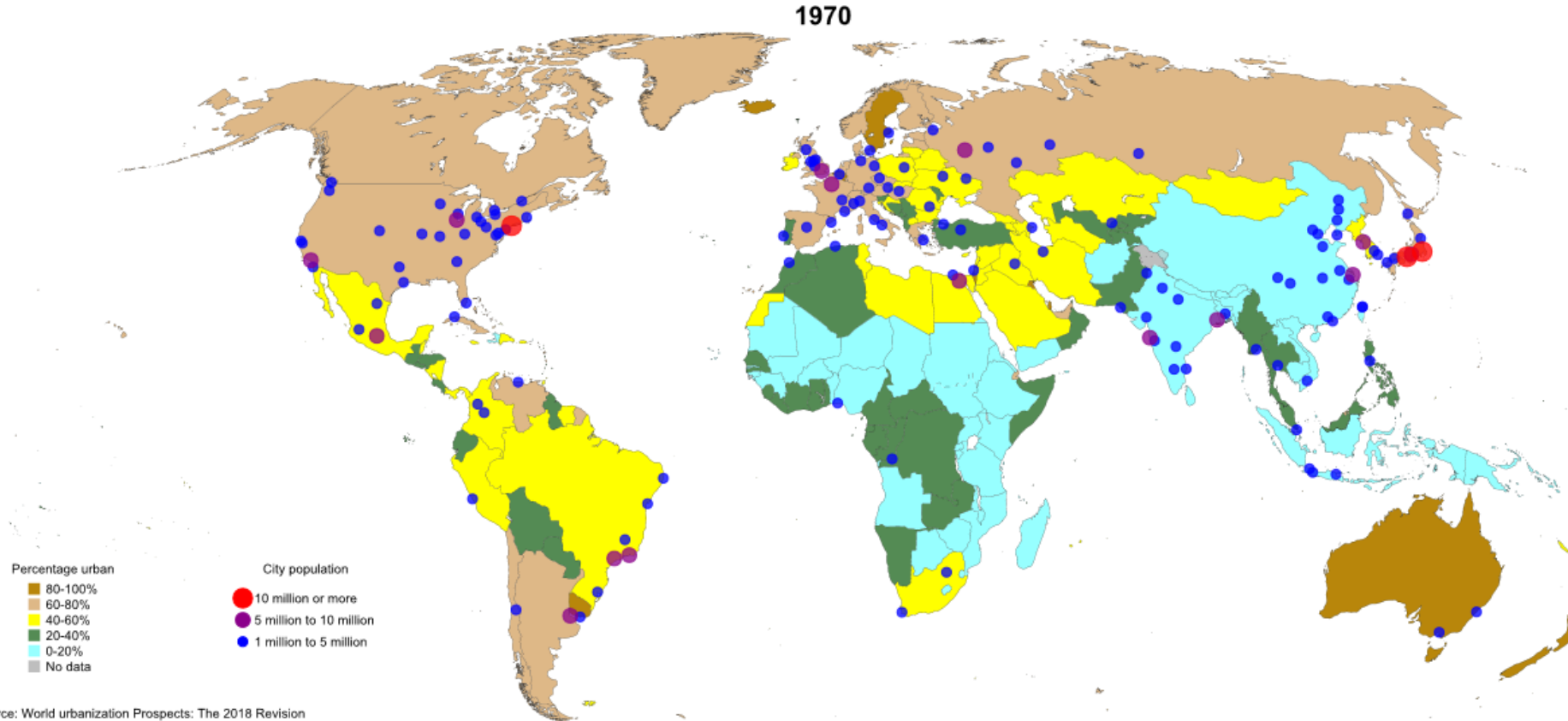


Urbanization of the world



Past half a century has seen rapid shifts from rural to urban

URBANIZATION OF THE WORLD



Mega cities
> 10 million

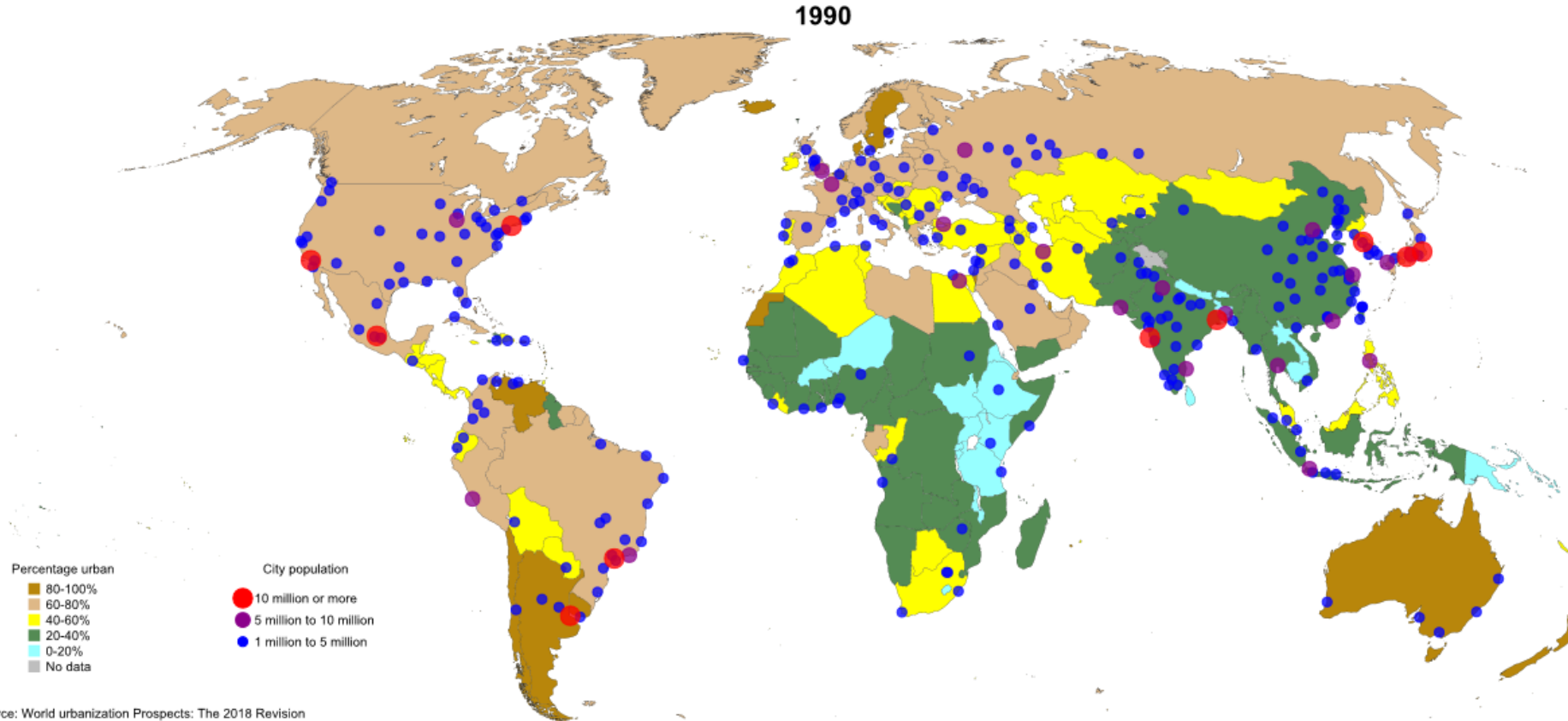
3

Data source: World urbanization Prospects: The 2018 Revision
The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties. Final boundary between the Republic of Sudan the Republic of South Sudan has not yet been determined. A dispute exists between the Governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

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Urban population – 37% (mid 70's)

URBANIZATION OF THE WORLD



Mega cities
> 10 million

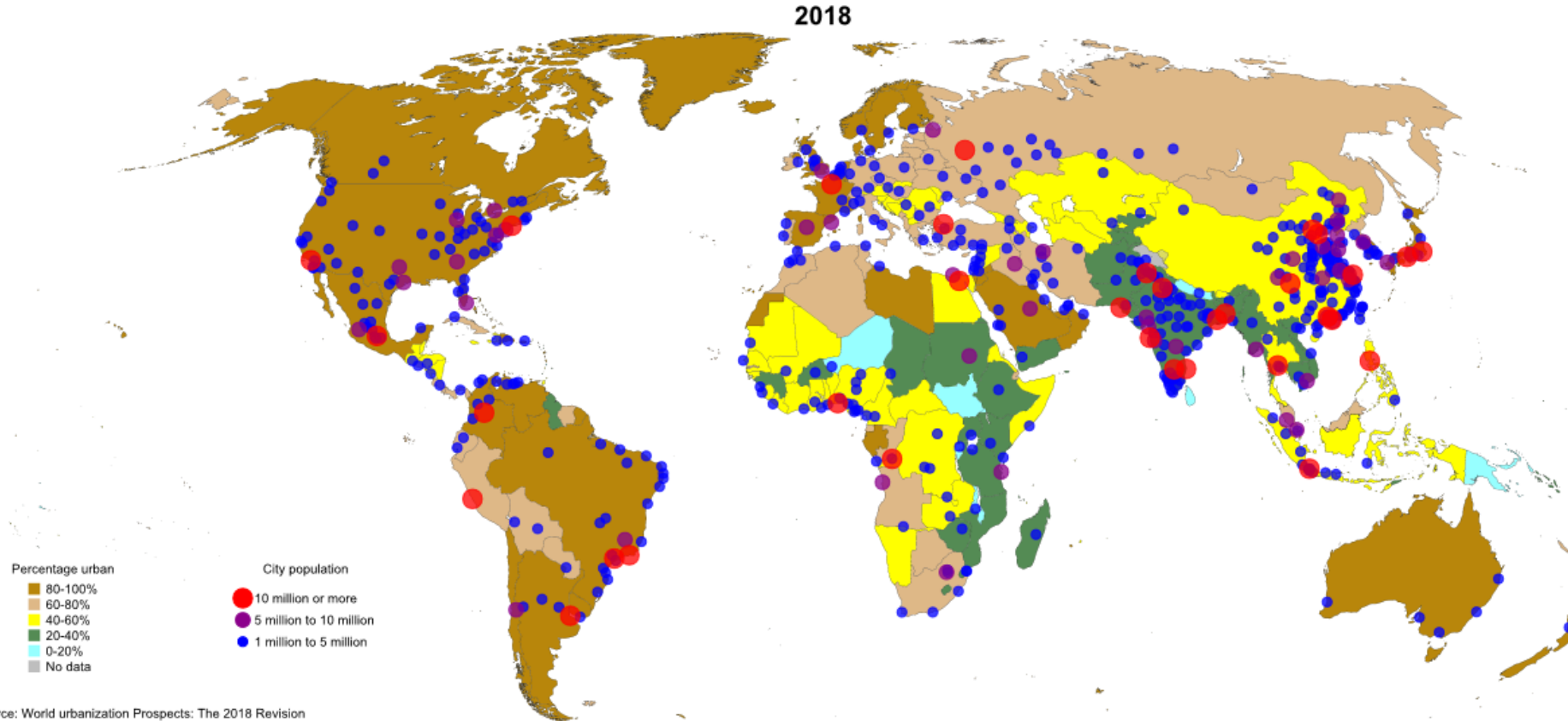
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Data source: World urbanization Prospects: The 2018 Revision
The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties. Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined. A dispute exists between the Governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

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Urban population – 45% (mid 90's)

URBANIZATION OF THE WORLD



Mega cities
> 10 million

33

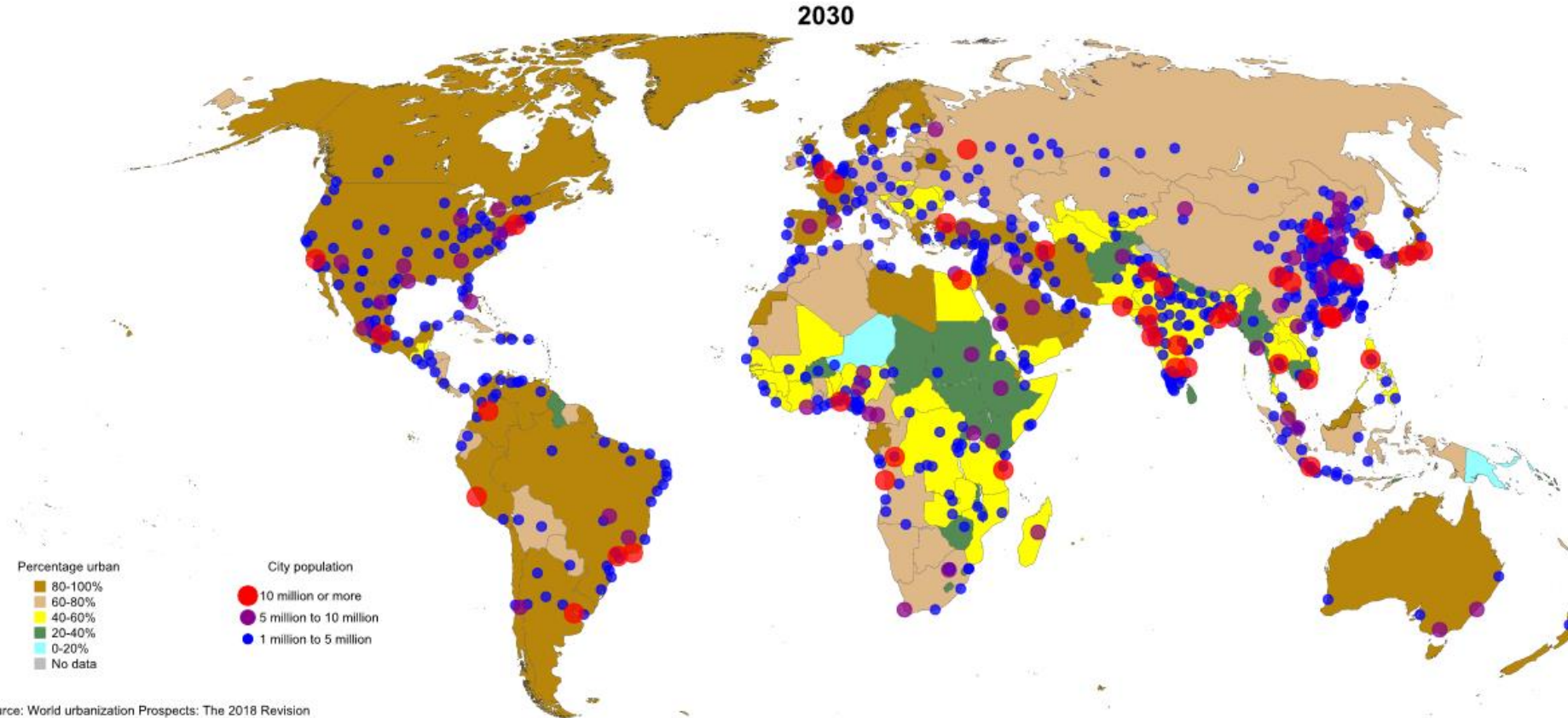
Data source: World urbanization Prospects: The 2018 Revision

The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties. Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined. A dispute exists between the Governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

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Urban population – 55% (2018)

URBANIZATION OF THE WORLD



Mega cities
> 10 million

43

Data source: World urbanization Prospects: The 2018 Revision
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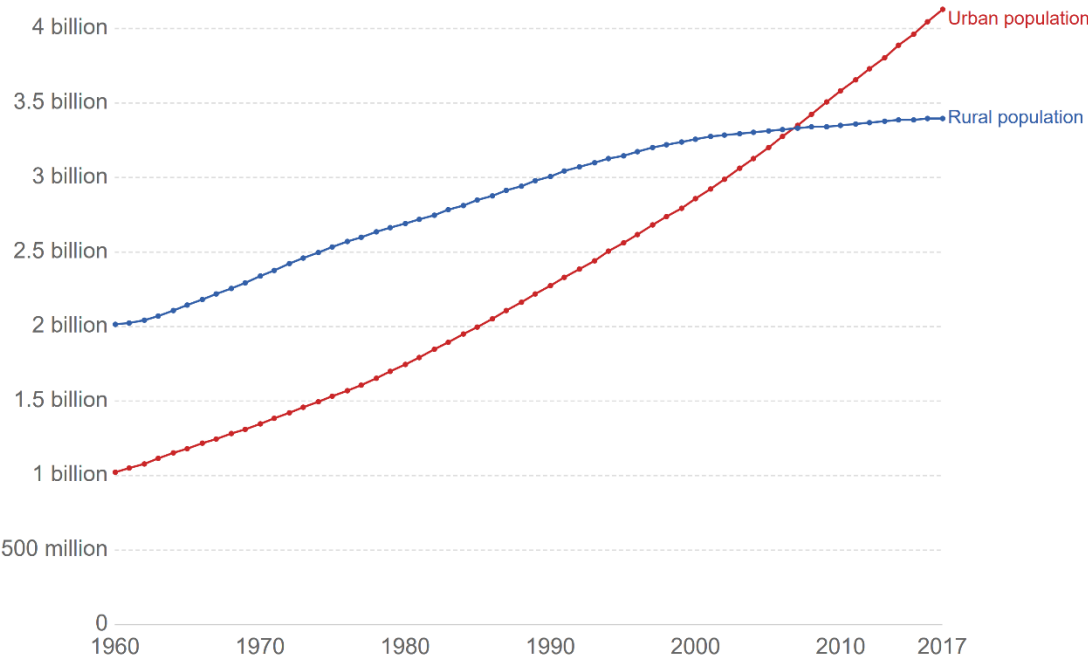
Urban population – 60% (2030) (projected to increase to 68% by 2050)

URBANIZATION OF THE WORLD



Urban and rural population, World

The total number of people living in urban or rural areas. Urban populations are defined based on the definition of urban areas by national statistical offices.

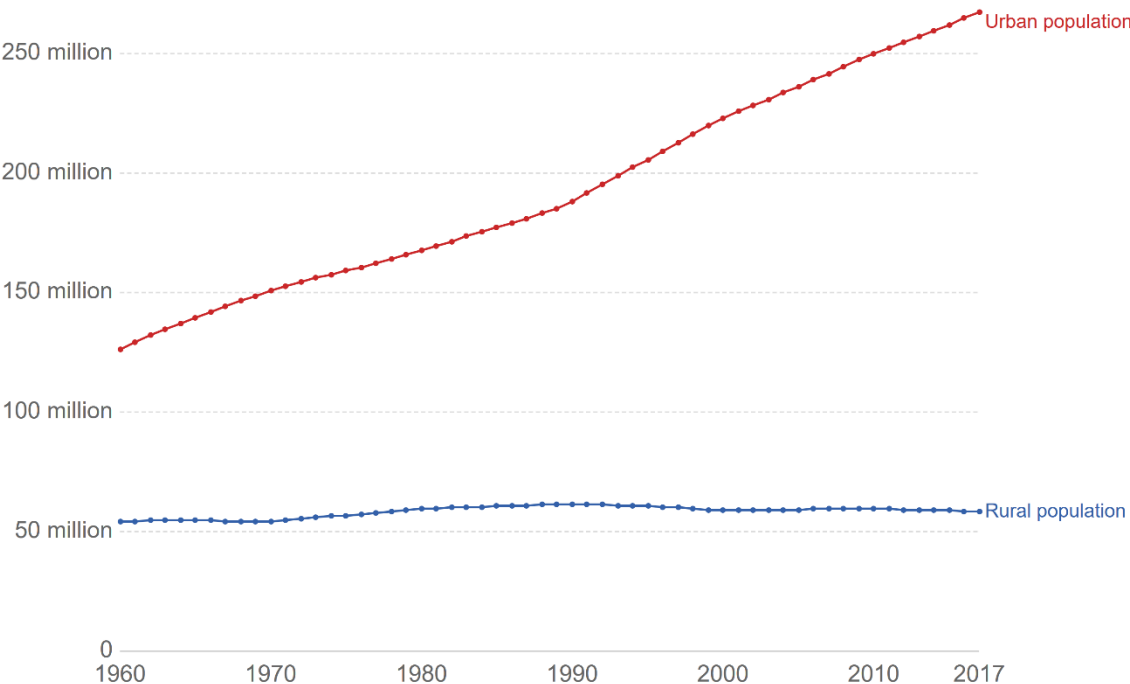


Source: World Bank, based on UN estimates

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Urban and rural population, United States

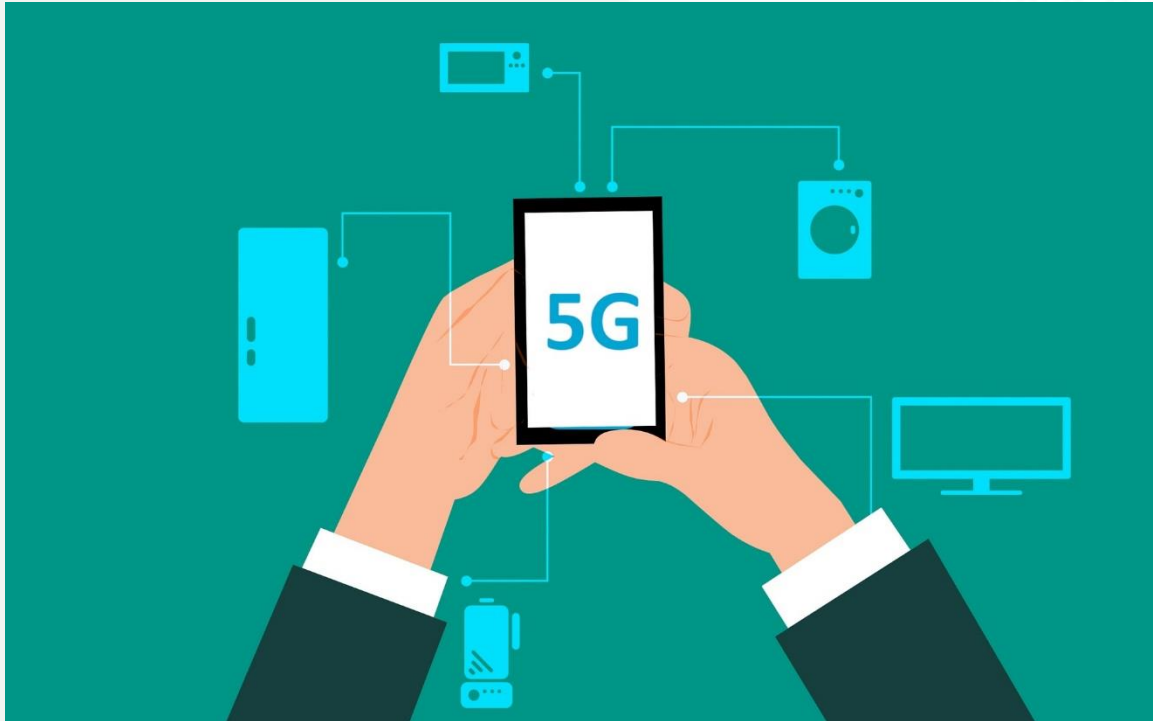
The total number of people living in urban or rural areas. Urban populations are defined based on the definition of urban areas by national statistical offices.



Source: World Bank, based on UN estimates

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Internet – World Wide Web – Broadband – Smartphone – 4G – Social Media



Last couple of decades saw tremendous advances in telecommunications and technology fueled by explosive growth in the Internet and bandwidth availability across the globe.

The rapid urbanization and associated issues served as a catalyst for new wave of thinking and envisioning the concept of Smart Cities.

WHAT IS A SMART CITY?

Definition varies ...

“A city is smart when investments in (i) human and social capital, (ii) traditional infrastructure and (iii) disruptive technologies fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance” - *Deloitte Consulting (Generic definition)*

“One that makes optimal use of all the interconnected information available today to better understand and control its operations and optimize the use of limited resources” – *IBM (Technology focused definition)*

“A ‘smart city’ means ‘smart citizens’ – where citizens have all the information they need to make informed choices about their lifestyle, work and travel options” – Manchester Digital Development Agency, UK (*Citizen focused definition*)



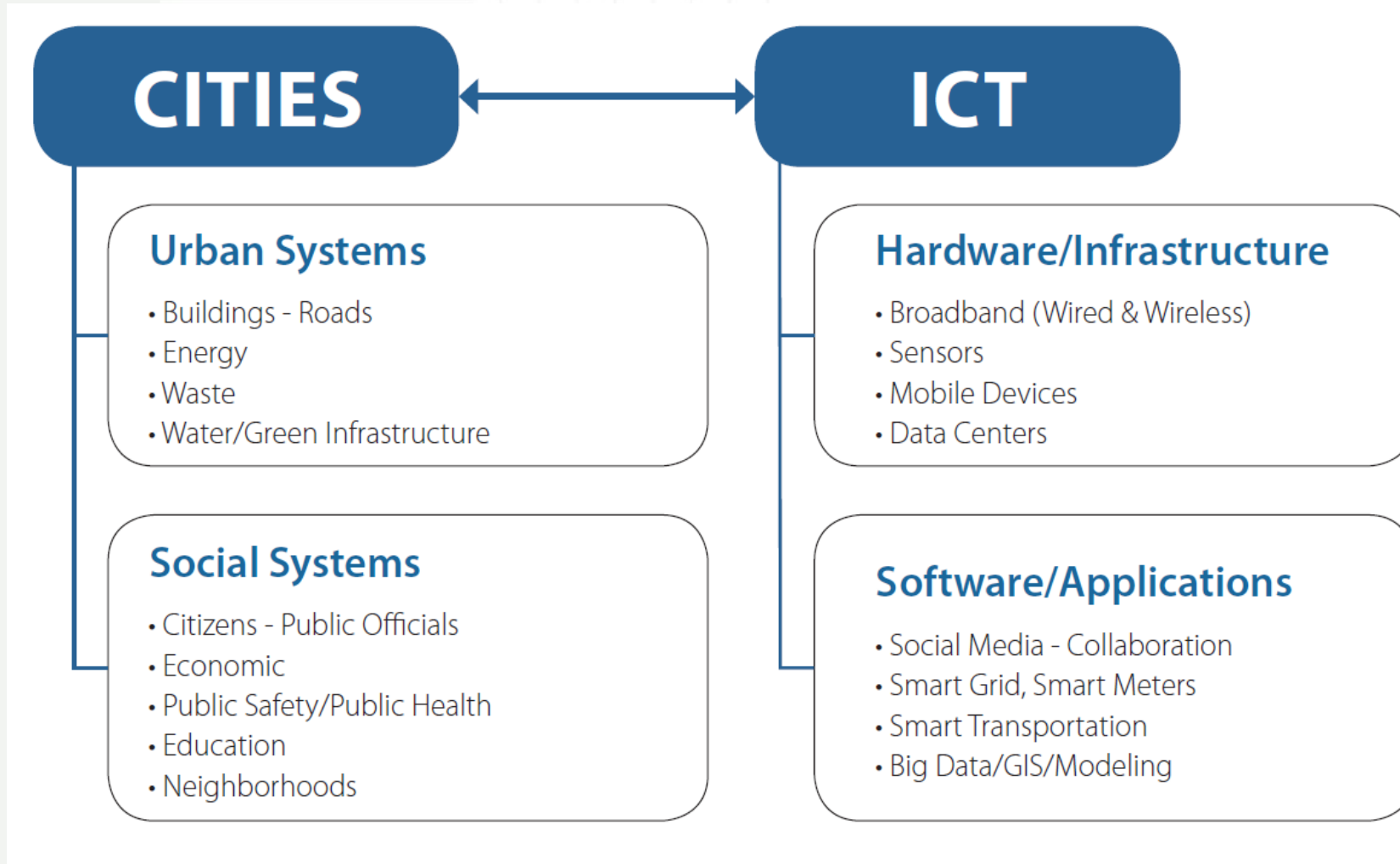
**SMART
CITY**

Smart City Initiatives involve:



- Information and communication technologies (ICTs) that generate and aggregate data;
- Analytical tools which convert that data into usable information; and
- Organizational structures that encourage collaboration, innovation, and the application of that information to solve public problems.

Source: Center for City Solutions and Applied Research, National League of Cities (2016)

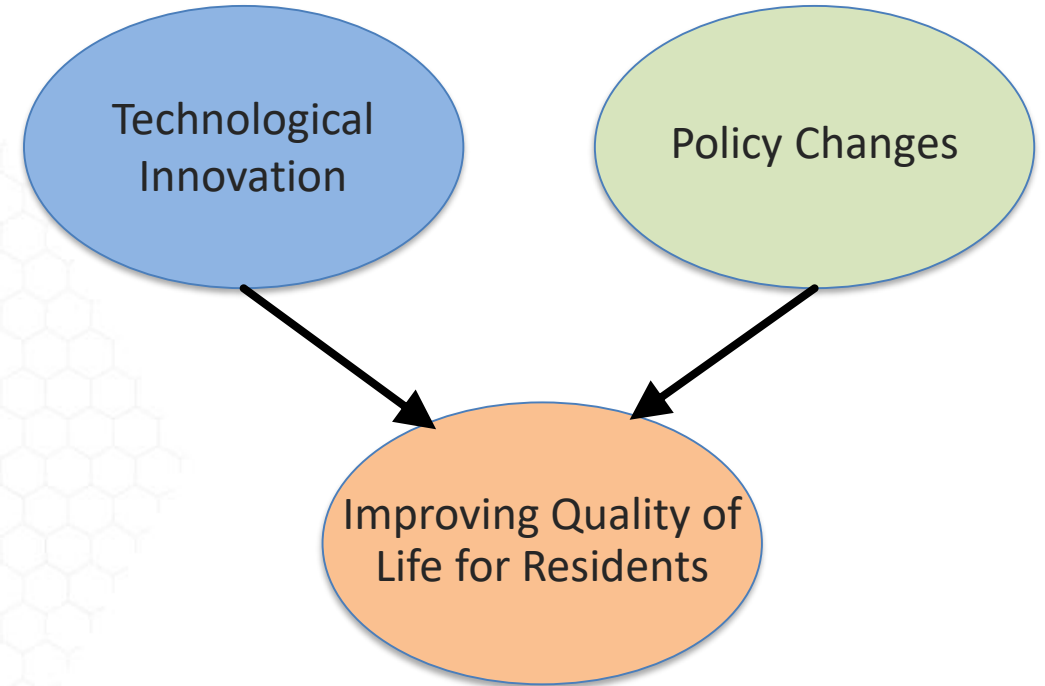


Source: Smart Cities and Sustainability Initiative (American Planning Association, 2015)

COMMON COMPONENTS OF SMART CITIES

- Supporting Infrastructure (e.g., broadband infrastructure/sensor deployment)
- Technology/Applications/Data
- Sustainability/Resiliency/Energy
- Social Equity & Digital Inclusiveness
- Leadership and Governance
- Robust Civic Engagement

Source: Smart Cities and Sustainability Report - APA



Examples

CASE STUDIES: PARKING IN MASSACHUSETTS

- Four Towns/Cities:
Marlborough,
Middleborough,
Oak Bluffs,
Cambridge
- Small to medium
scale urban areas
- Policy-Based, not
technology-based



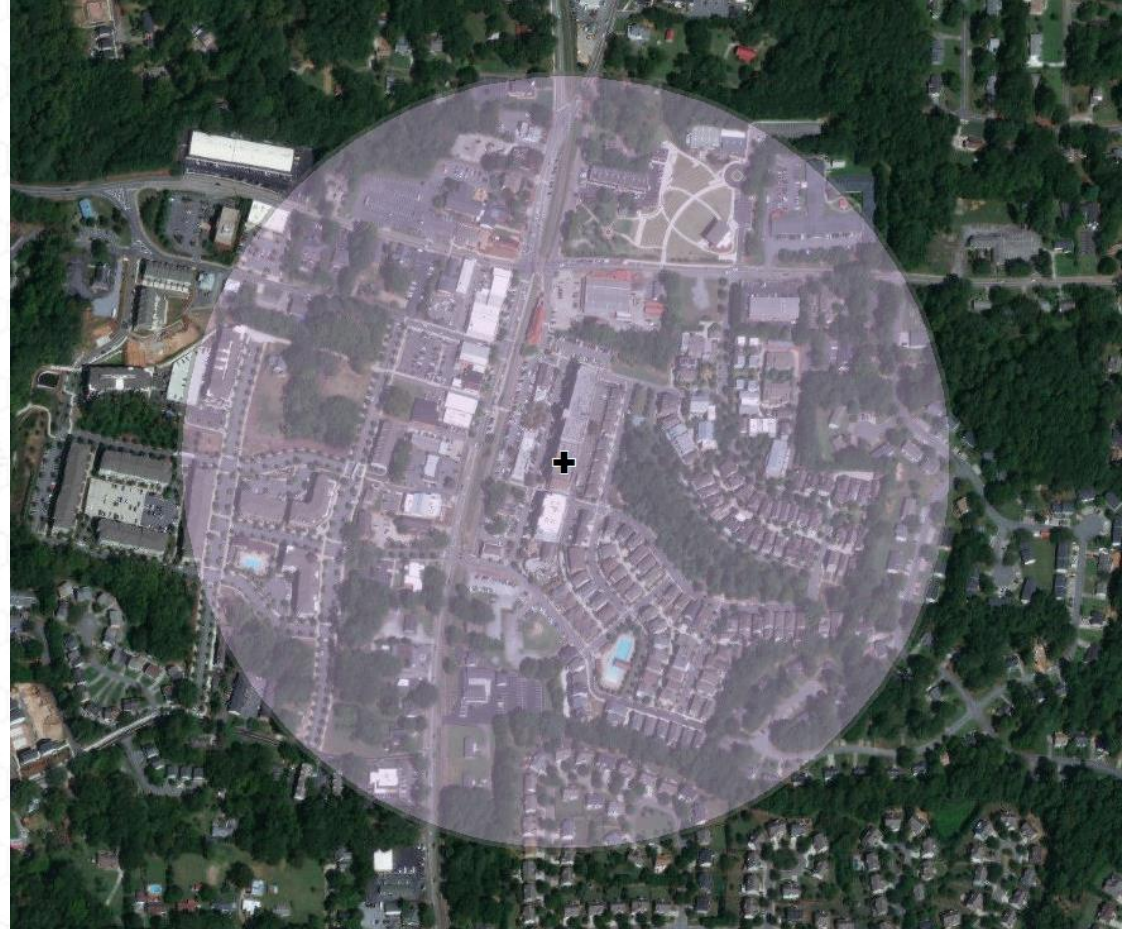
Marlborough, MA

Source: Google Maps

CASE STUDIES: PARKING IN MASSACHUSETTS

Example Strategies:

- Compact Car Spaces
- Temporary Grassy/Earthen Parking Spaces
- Off-Site Residential Parking within 0.25 miles



Example: 0.25-mile radius from
downtown residences

CASE STUDIES: PARKING IN WELLINGTON, NZ



Source: ITS International (2018)

Problems:

- 30% of downtown traffic is searching for parking
- Payment process is inefficient

Solutions:

- In-ground parking space availability sensors
- Payment by Smartphone App

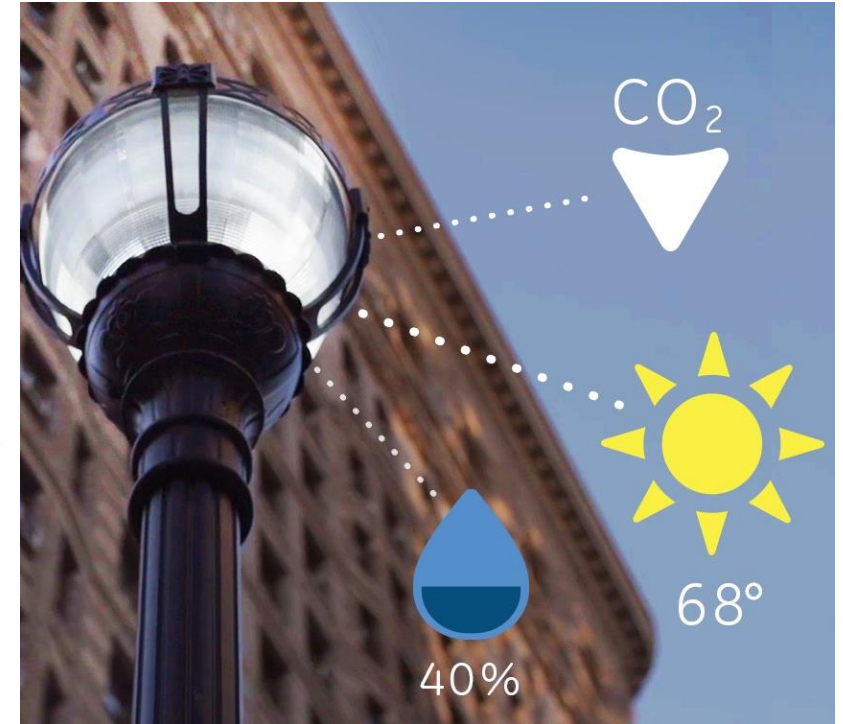


Research from the past 2-3 years has focused on developing smart parking strategies that do not require the installation of sensors and other infrastructure.

- Solutions depending on wi-fi and smartphone only
- Functional even with small numbers of users
- Solutions are cost-effective, but sacrifice some accuracy



Source: GE Reports



Street Lamps with Real-time sensors and micro processors

Generate and analyze data that could eventually notify city dwellers about open parking spaces, air quality and traffic. Potentially could even communicate with emergency first responders before they arrive on the scene.

CASE STUDIES: 'SMART' TALKING STREET LAMP, NYC



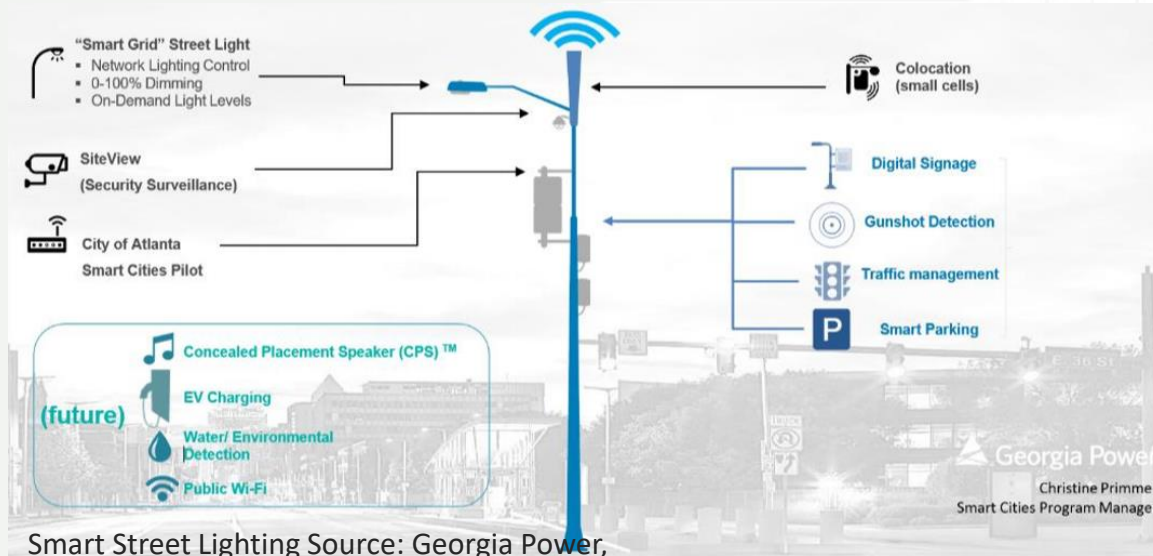
Source: Current, a GE Startup

- A demonstrative street light that talks to passerby & and their phones
- Digital screen with speakers
- Embedded Sensors and communication modules
- Video surveillance
- Information kiosks
- Unified platform for information

VIRGINIA AVENUE SMART CORRIDOR



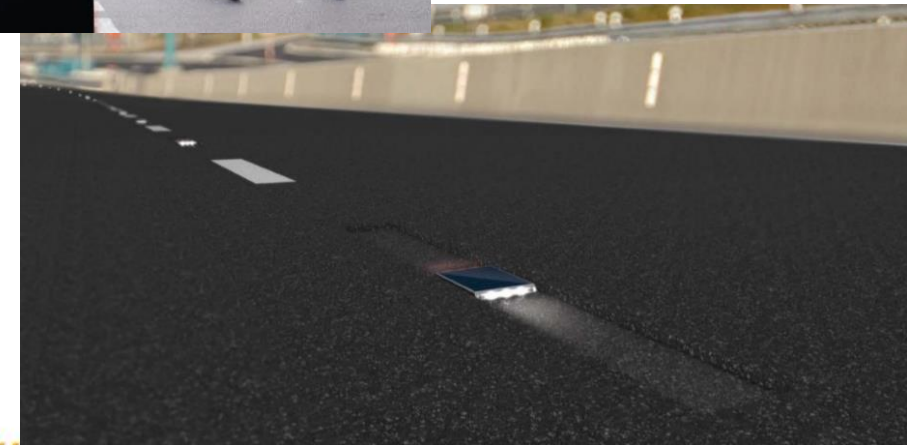
Aerotropolis Atlanta recently released a document surveying numerous smart technologies in relation to their Virginia Avenue Smart Corridor project.



Digital Wayfinding
Source: Studio Binocular

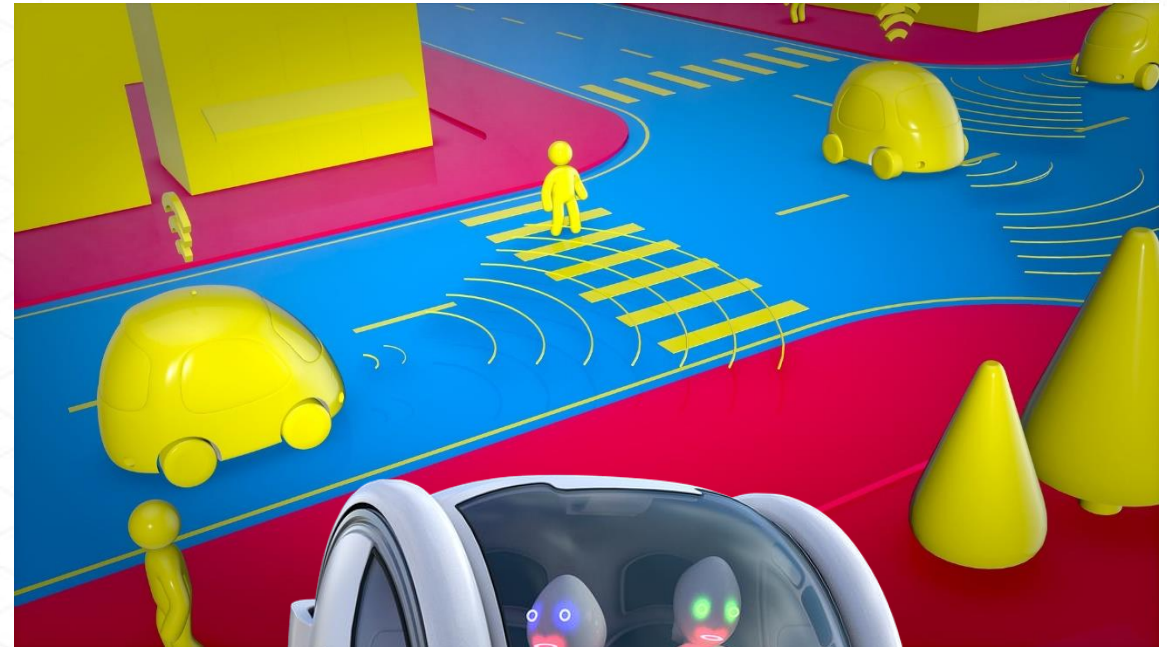
Smart Dots in Centerlines
Source: The Ray

- Adaptive Traffic Control
- In-Pavement Illuminated Crosswalks
- Roadside Sensors
- Autonomous Shuttles
- Flexible Curbs/Lanes
- Many more...



AUTONOMOUS VEHICLES AND ITS IMPACT ON CITIES

- Dramatic increase in ride sharing
- Significant reduction accidents
- Reduced demand for parking lots and garages – reclaim open spaces
- Improved health outcomes (less driving induced stress)
- Increased quality of life – less pollution, less emissions
- Potential to make streets smaller and make sidewalks bigger as future roadway design will focus more for AV navigation



BUILDING A SMART CITY INFRASTRUCTURE

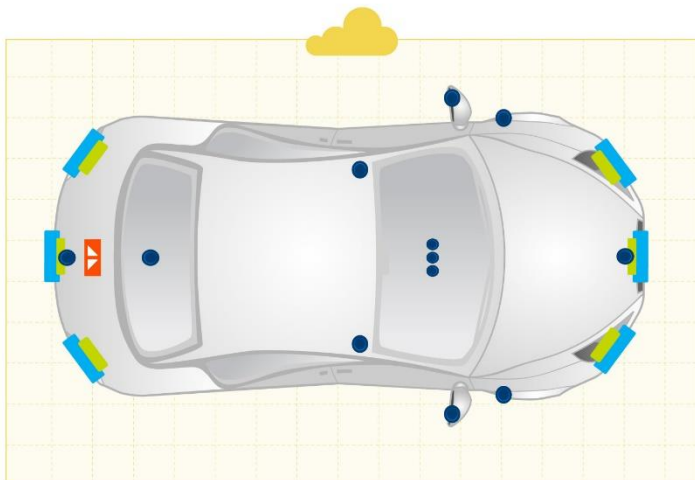


AUTONOMOUS VEHICLE PLATFORM

The sensors, hardware and software provided by Intel and Mobileye give autonomous vehicles their ability to recognize the environment around them. This technology creates the building blocks for autonomous vehicles (AV) and includes a suite of cameras, lidar, radar, and computing and mapping technologies.

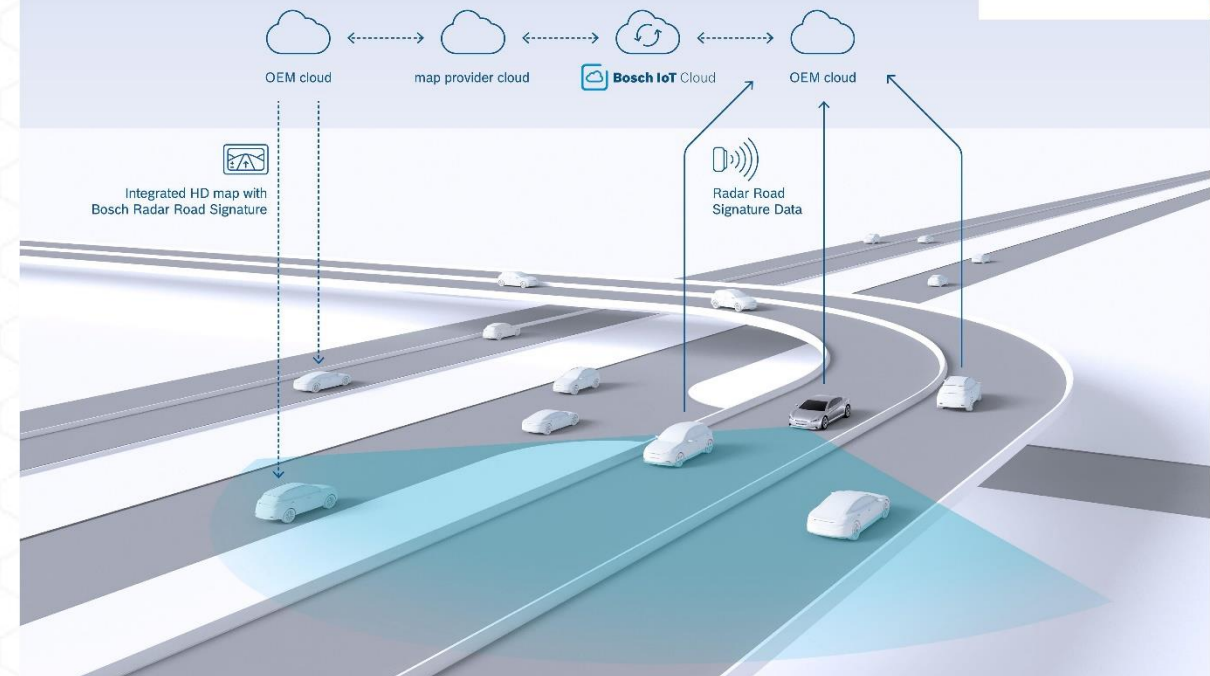
Click on an autonomous tool below to find out more information

- CAMERAS
- LIDAR
- RADAR
- ROADBOOK
- COMPUTING



Intel / MobileEye

Bosch Radar Road Signature



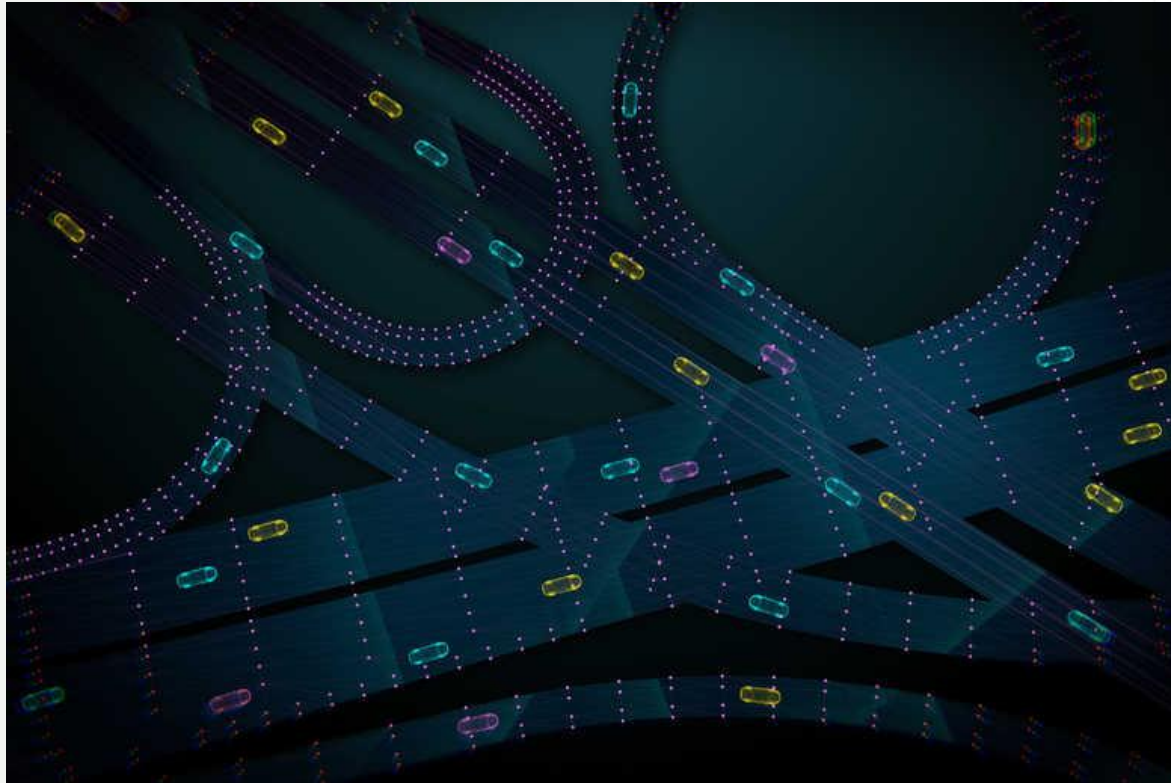
Bosch

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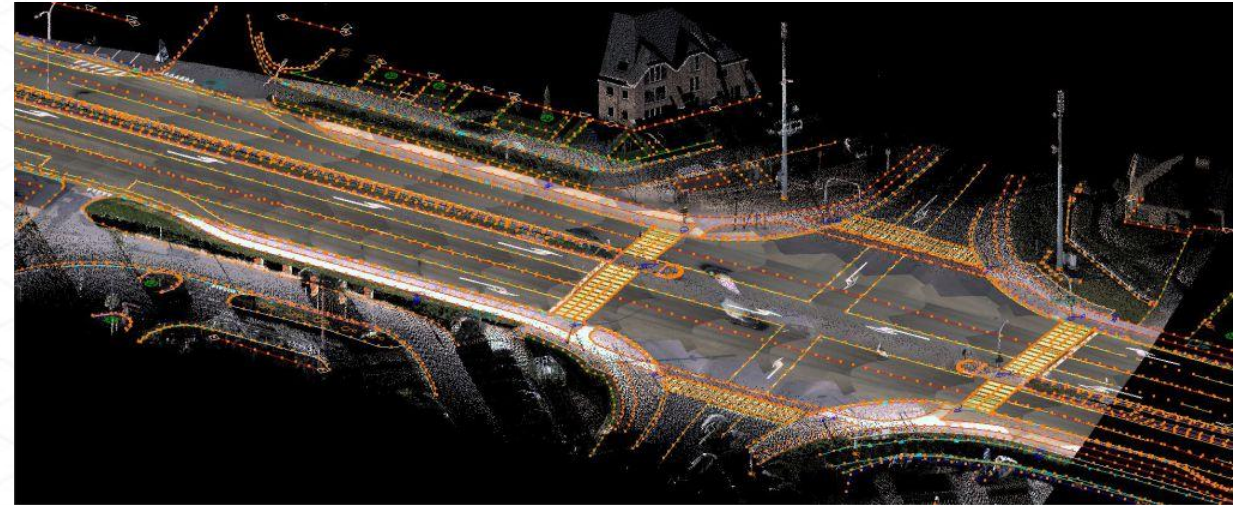
AV FORMS – IMPACTS ON INFRASTRUCTURE DESIGN



INFRASTRUCTURE READINESS -AUTONOMOUS VEHICLES



AV – Gigabit magazine



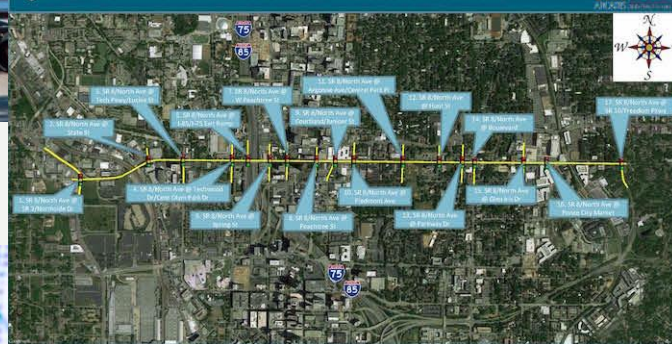
Civil Maps – Lidar Point Cloud – 3D Mapping

RENEW ATLANTA NORTH AVENUE SMART CORRIDOR



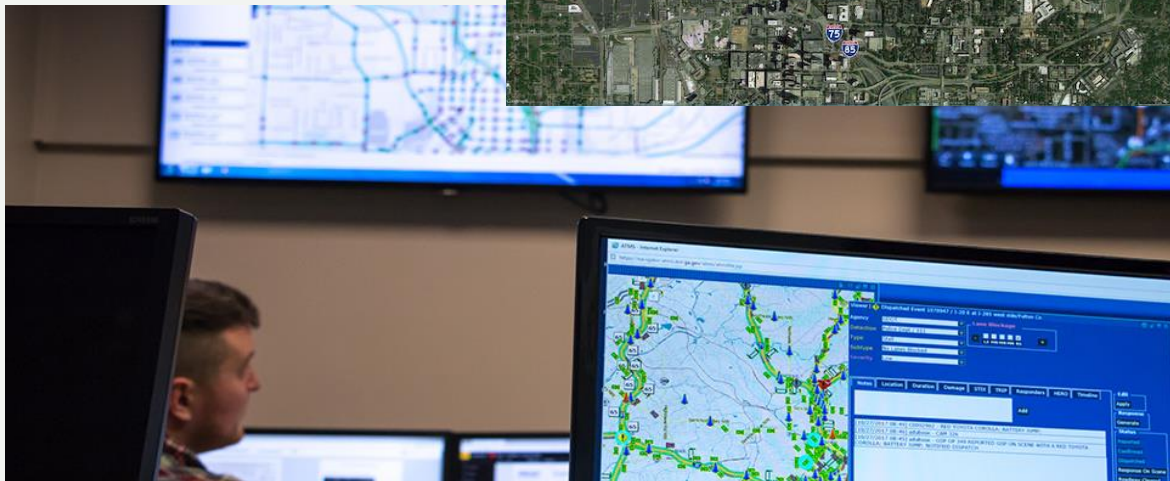
<https://youtu.be/QtFl800e0XU>

Figure 1 - North Avenue Smart Corridor Intersection Locations



Living lab” for IoT deployment.

- An innovative test of smart city technologies on a 2.3 miles stretch of downtown street.
- A research and development hub to gather and analyze real-time data to assist in short- and long-term transportation planning, policy, and regulations.
- Identify potential smart solutions for replication across different neighborhoods.
- Testing ground for smart traffic signals, intelligent street lights, wireless vehicle-to-infrastructure solutions and autonomous cars on the corridor.



Source: Atkinsglobal

CURIOSITY LABS @ PEACHTREE CORNERS



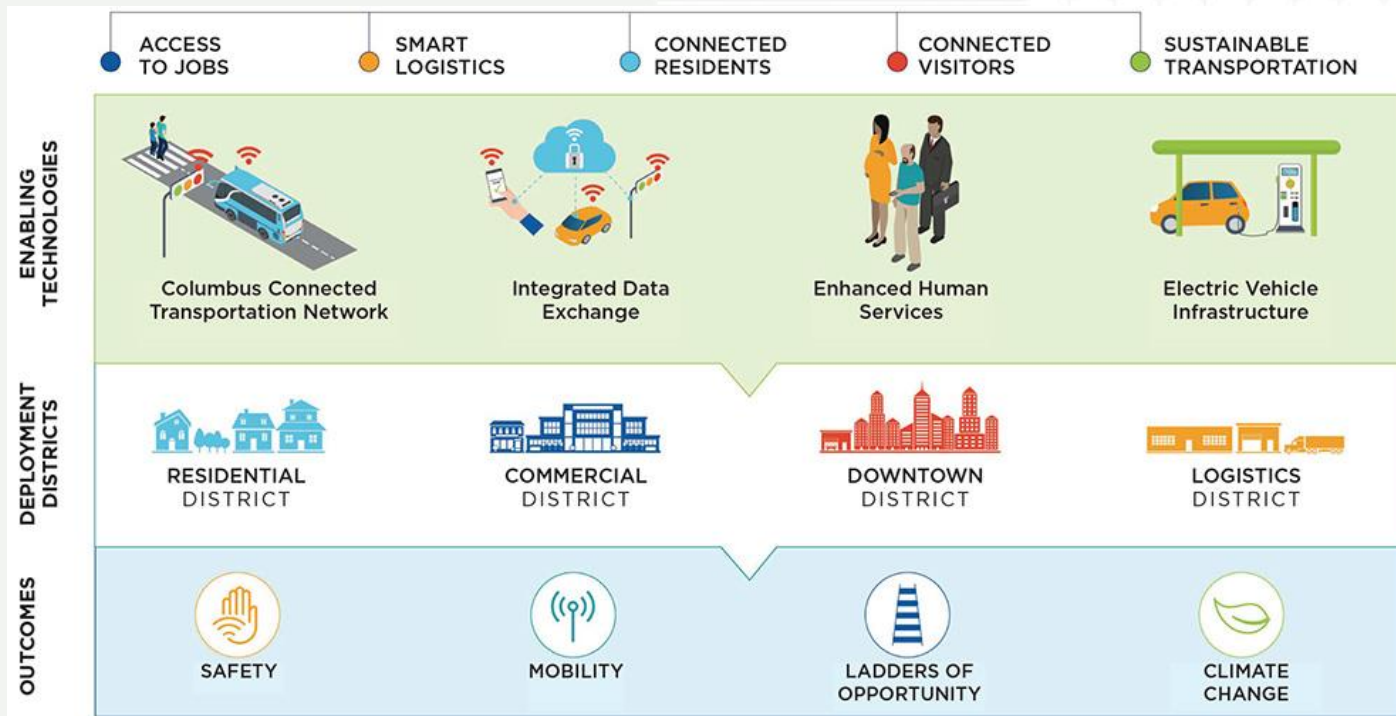
- Located in a 500 acre commercial office park in the City of Peachtree Corners, GA.
- 5G connectivity by Sprint.
- 1.5 mile AV test track on city owned right of way.
- AV track integrated with city infrastructure among people and vehicles.
- Designed as incubator for early stage IoT, Smart City and Mobility startups to experiment, grow and scale.
- Coaching and mentoring coupled with flexible office space.
- Facilitated connections to investors and prospective customers.

<https://curiositylabptc.com/>

<https://vimeo.com/366395639>

Test. Demo. Connect.

\$40 million US DOT Smart Challenge Winner (2016) - The Smart Columbus Vision is using technology to break down silos in an effort to improve quality of life, grow the economy, provide jobs and opportunity, lead in logistics, and foster sustainability.



more than a dozen projects, including

- vehicle connectivity system
- smart streetlighting
- pedestrian collision-avoidance system
- common payment system for multimodal trips
- patient scheduling at hospitals linking with transit schedules in an effort to reduce infant mortalities

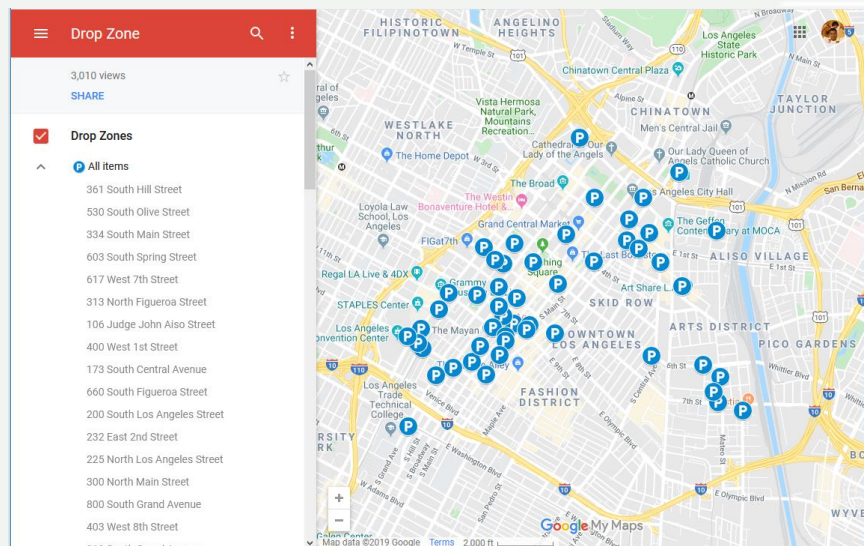
Source: U.S. Department of Transportation



Mobility Data Specification (MDS) to actively manage private mobility providers and the public right-of-way.

- Permitted shared use mobility providers (like scooters and bikes) must provide
- real-time information about how many of their vehicles are in use at any given time
- Location of vehicles are at all times
- Physical condition of vehicles

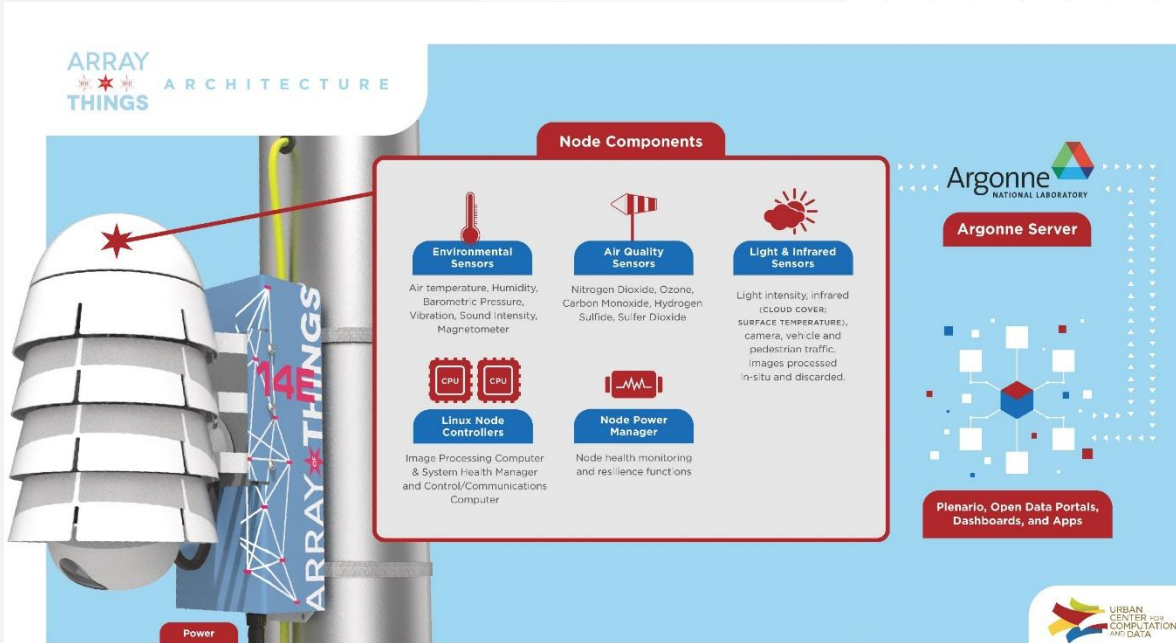
Source: <https://ladot.io/programs/dockless/>



Additional information includes:

- Parking Verification
- Operating Cost
- Customer Cost
- Vehicle Utilization
- Percent Battery Charge
- Start Trip Data
- End Trip Data

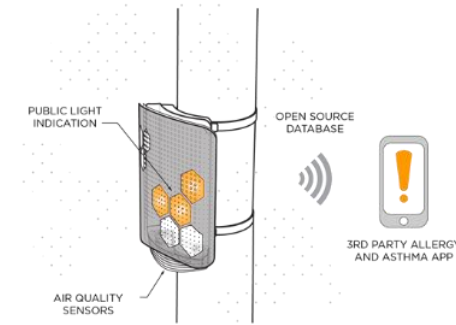
ARRAY OF THINGS @ CHICAGO



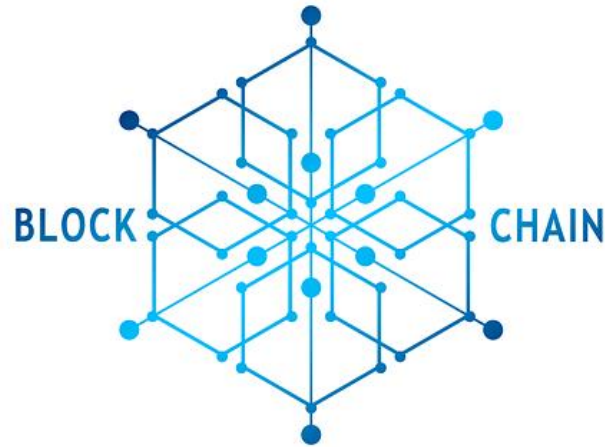
<https://arrayofthings.github.io/>



Urban sensing network of programmable modular nodes around cities
Collect real-time data on city's environment and infrastructure
Serve as a "fitness tracker" for the city
Measure factors that impact livability



SMART CITY DUBAI INITIATIVE – DUBAI BLOCKCHAIN BUSINESS REGISTRY



Collaborative effort to streamline the process of setting up and operating a business, roll out digital exchange of trade licenses and related documentation for all business activities, and ensure regulatory compliance across Dubai's business ecosystem.

The initiative will boost collaboration and efficiency at government institutions and “provide transparency, security and visibility in government transactions.

Power all government services with blockchain by 2020

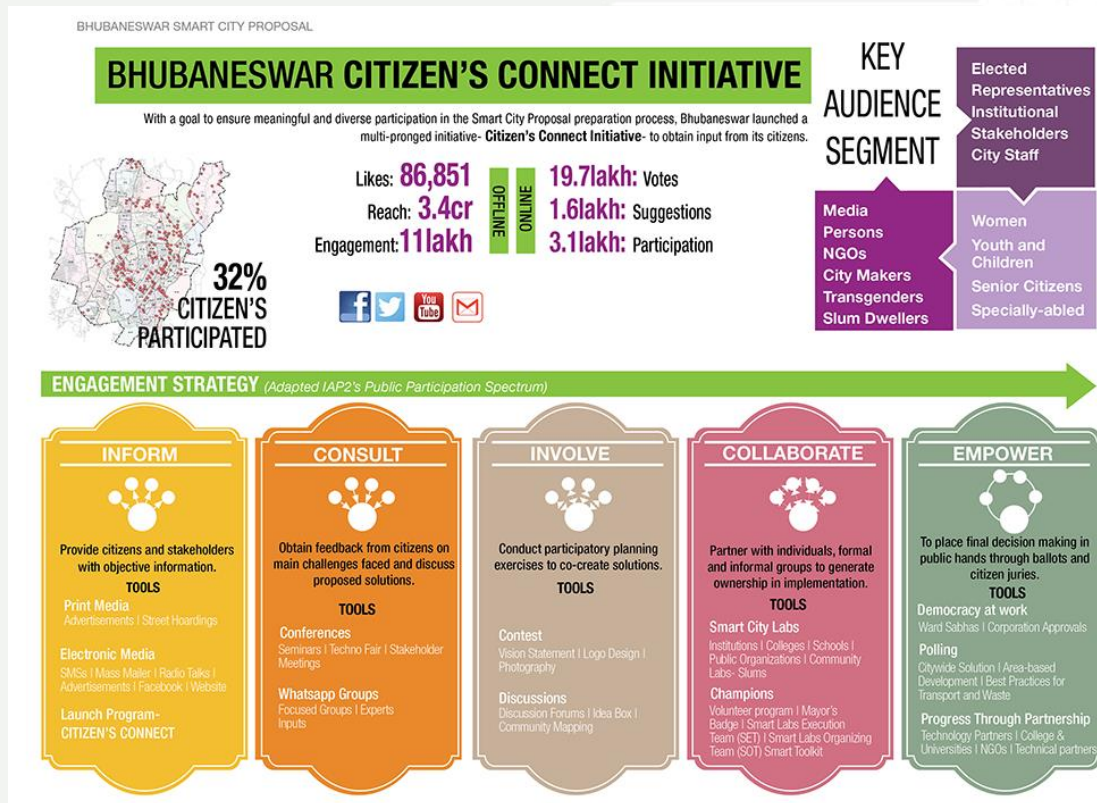
<https://www.coindesk.com/dubai-government-unveils-blockchain-business-registry>

<https://youtu.be/BvavBqaDZgQ>



SMART CITY PLAN – BHUBANESHWAR, INDIA

Citizens Connect Initiative - public outreach effort for meaningful and diverse participation in the plan development process



Source: Bhubaneswar Smart City Proposal / IBI Group
https://youtu.be/R-b-xXeT9_k

Citizen-driven vision for the future for the city.

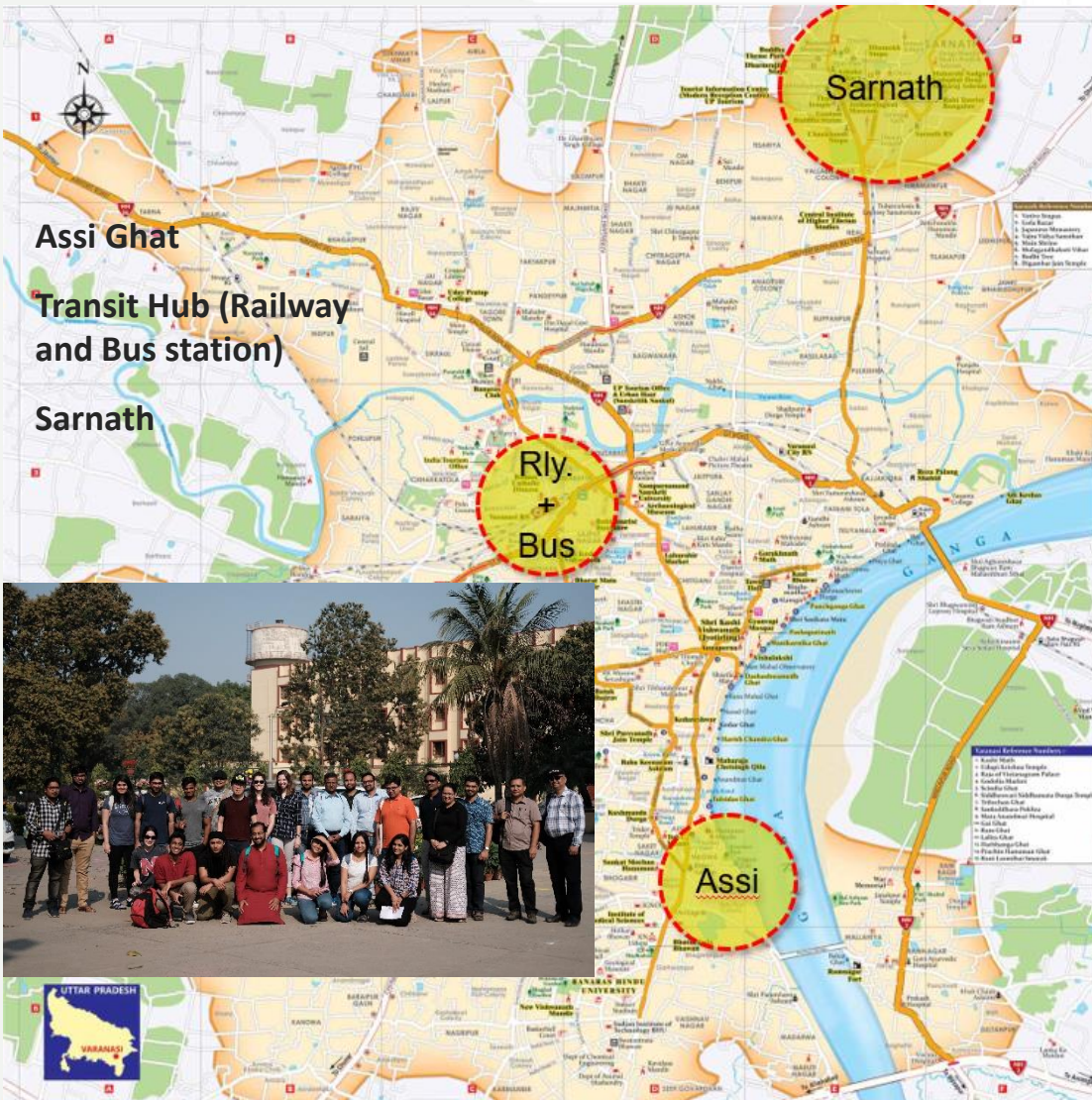
Use of technology to help residents gain better access to city services, and improve the overall quality of life.

The goal was to engage residents in discussions to identify gaps in access to technology.

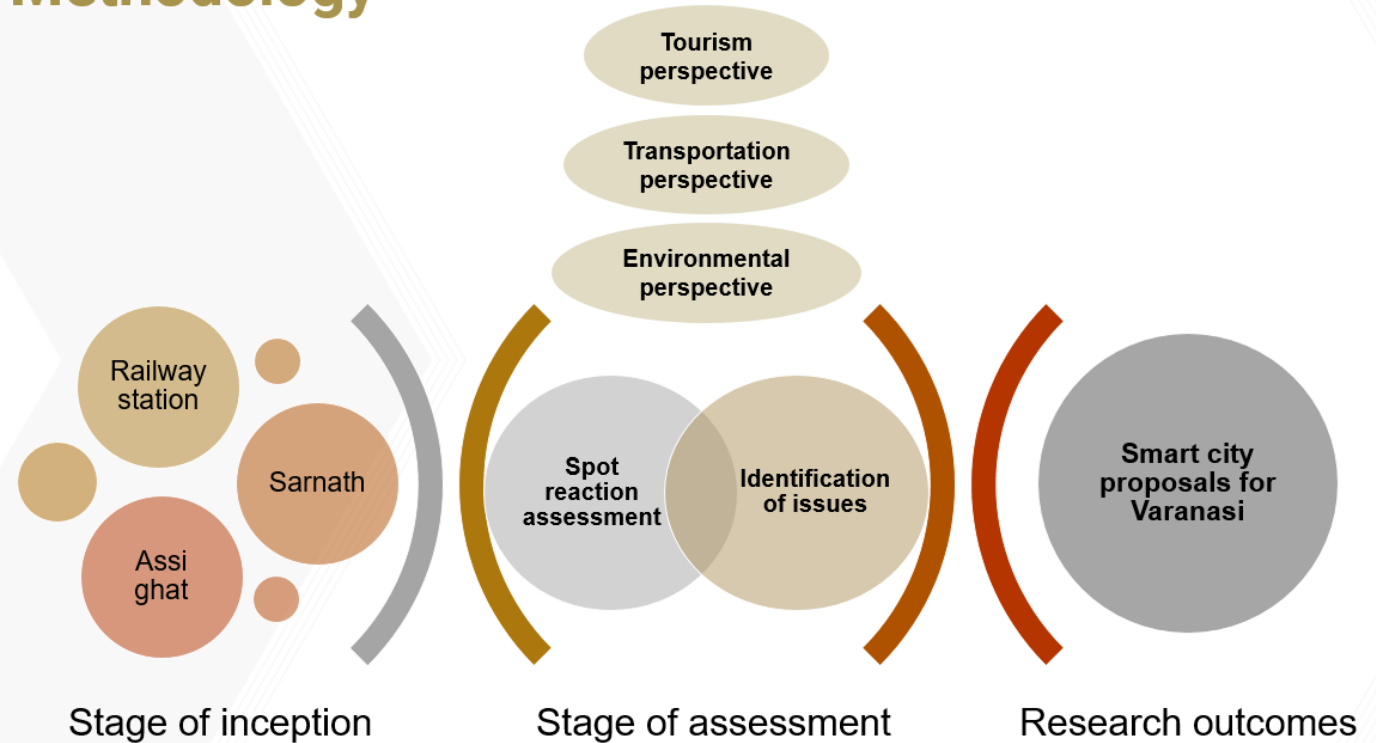
Calls for the redevelopment of 985 acres around the centrally-located transit station into a vibrant 24/7 destination called the Bhubaneswar Town Center District.

*APA National Planning Excellence Awards (2017):
Pierre L'Enfant International Planning Award*

EXAMINING SMART CITY AMBITIONS OF VARANASI, INDIA



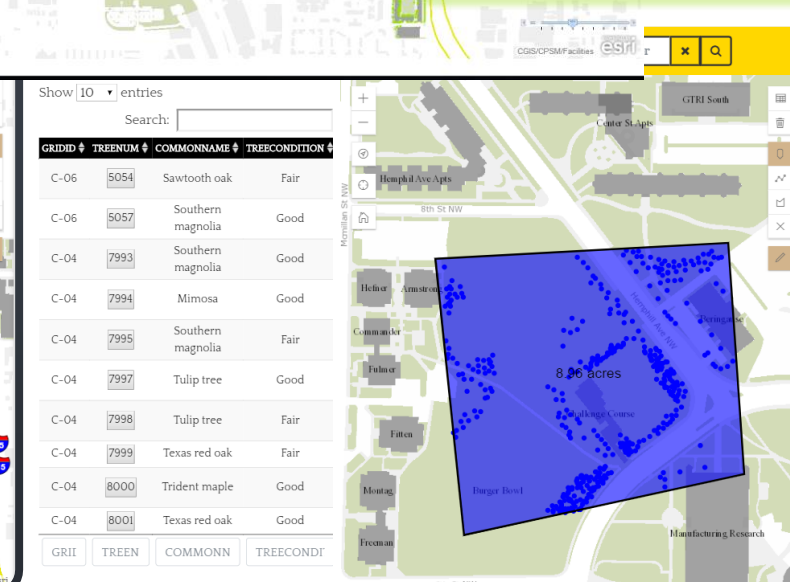
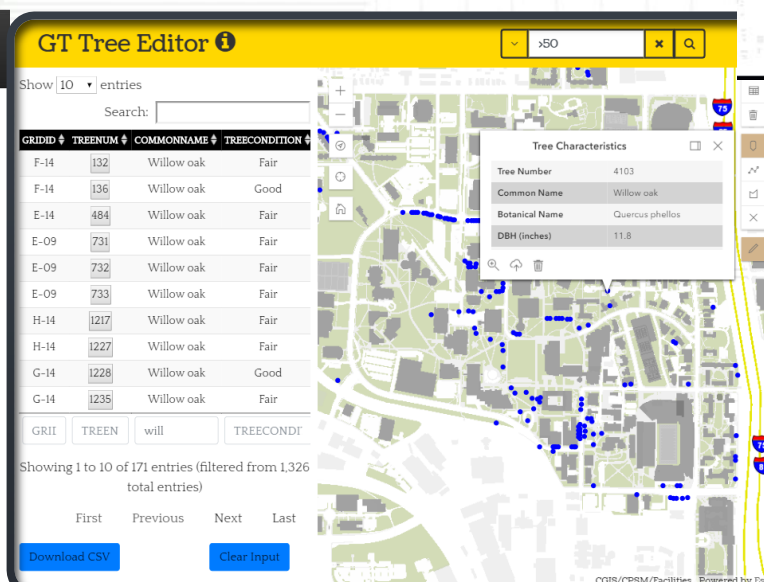
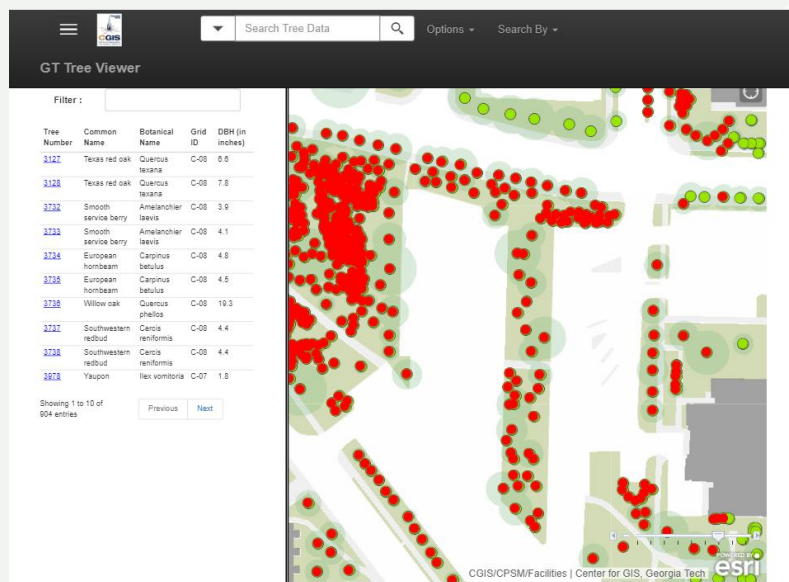
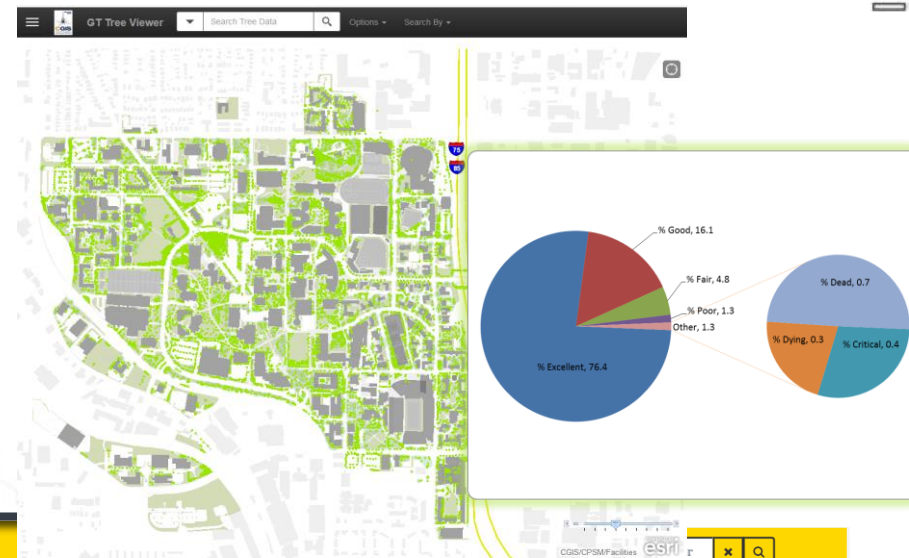
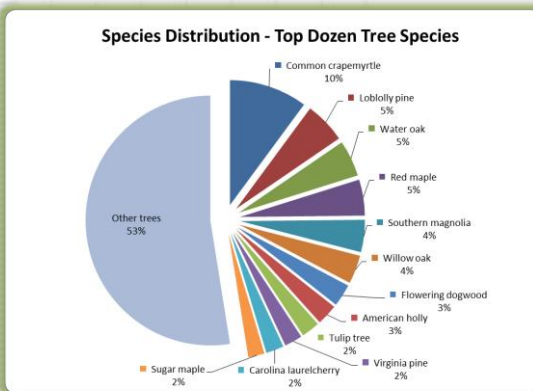
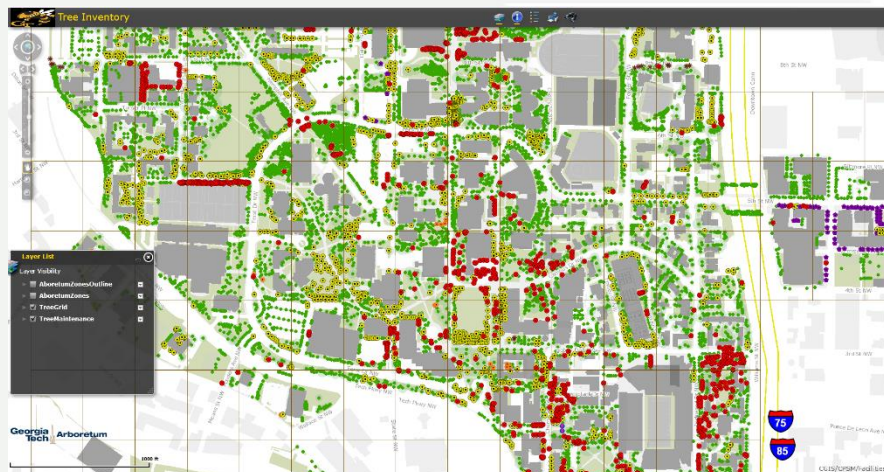
Methodology



Collaborative graduate planning studio (Spring 2019):
Georgia Tech, IIT (KGP), IIT (BHU)

<http://varanasistudio.design.gatech.edu/>

“SMART TREES” – URBAN FORESTRY @ GT



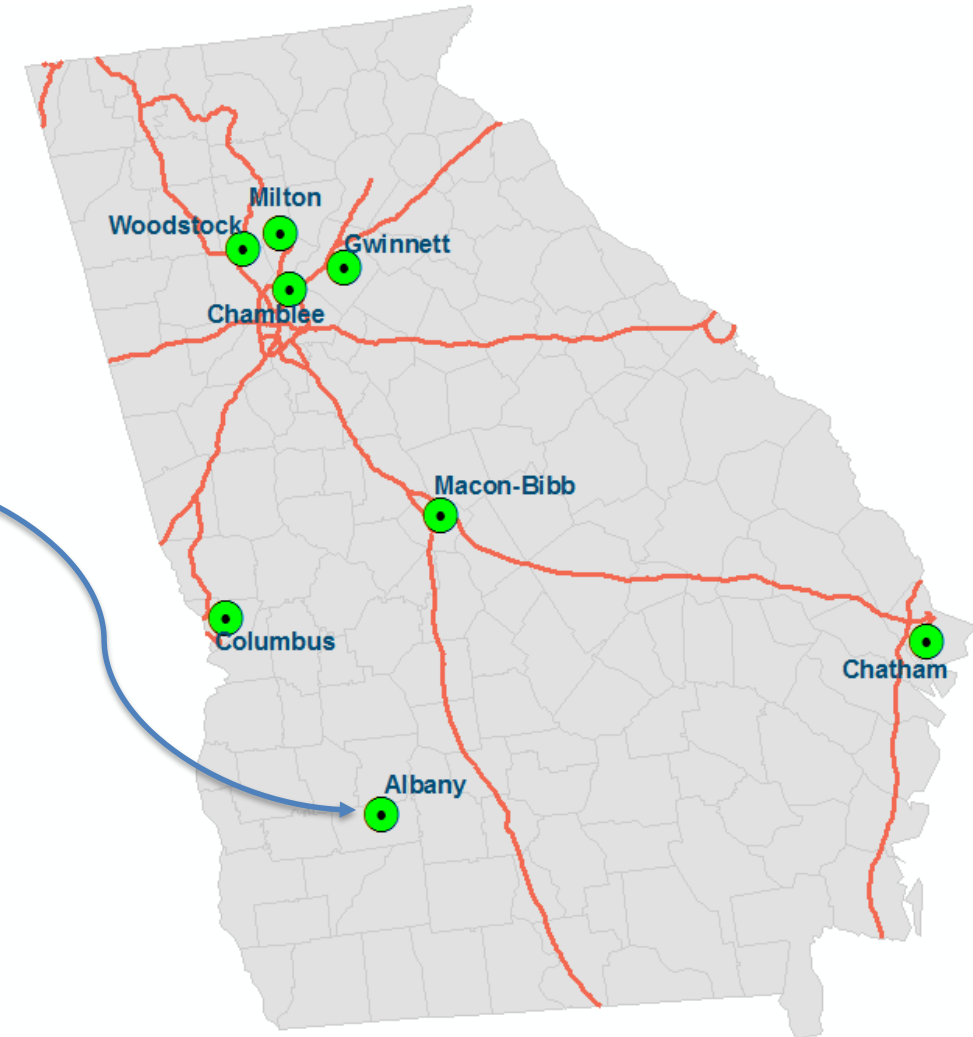
<http://carto.gis.gatech.edu/gttree-viewer>

City of Albany, GA



Albany Housing Data Analytics and Visualization Initiative
-Developed and evaluated an automated housing registry

(2018)

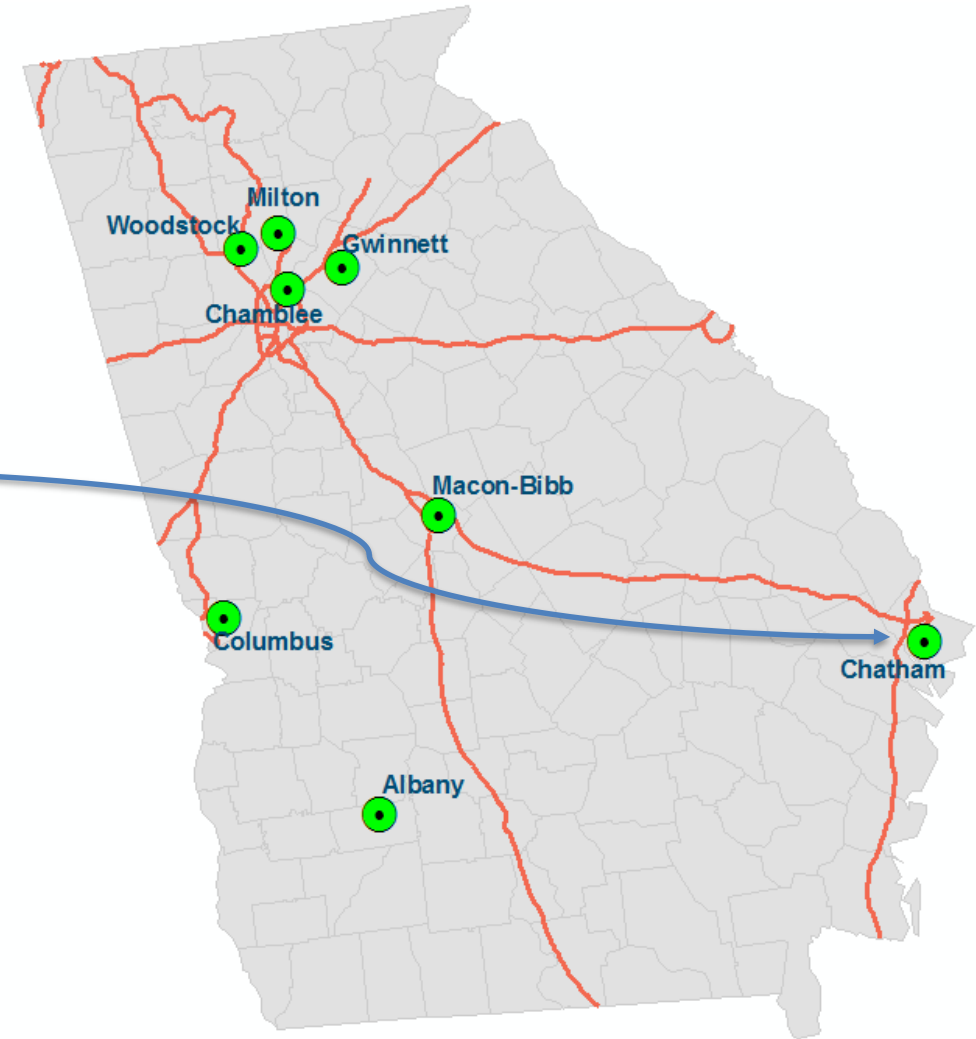


Chatham County, GA



Designed, developed, and tested a pilot sensor network for measuring sea level flood risk in order to inform government officials and other key stakeholders in real-time during natural disasters and storms

(2018)

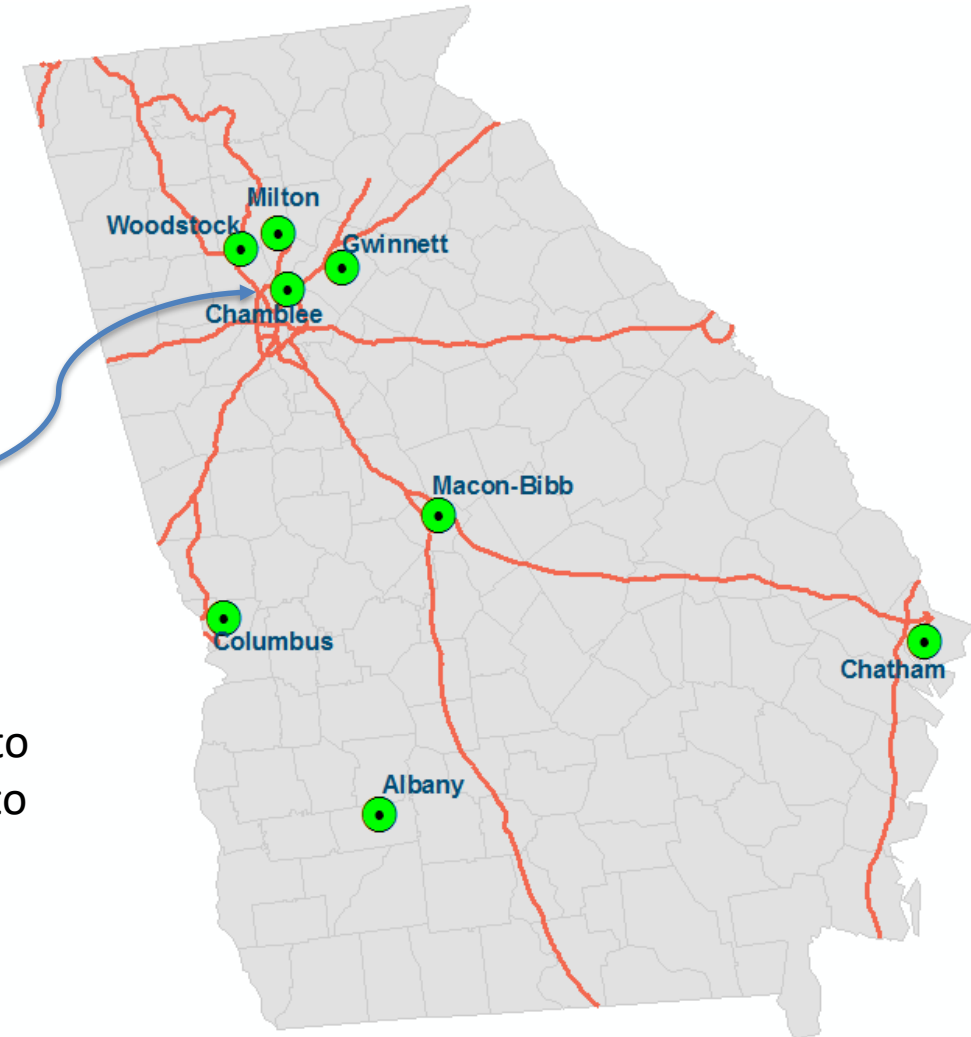


City of Chamblee, GA



Studied the issues, technology, and best practices related to the use of Shared Autonomous Vehicles (SAV) for helping to address the first-/last-mile problem in relation to the Chamblee MARTA station.

(2018)

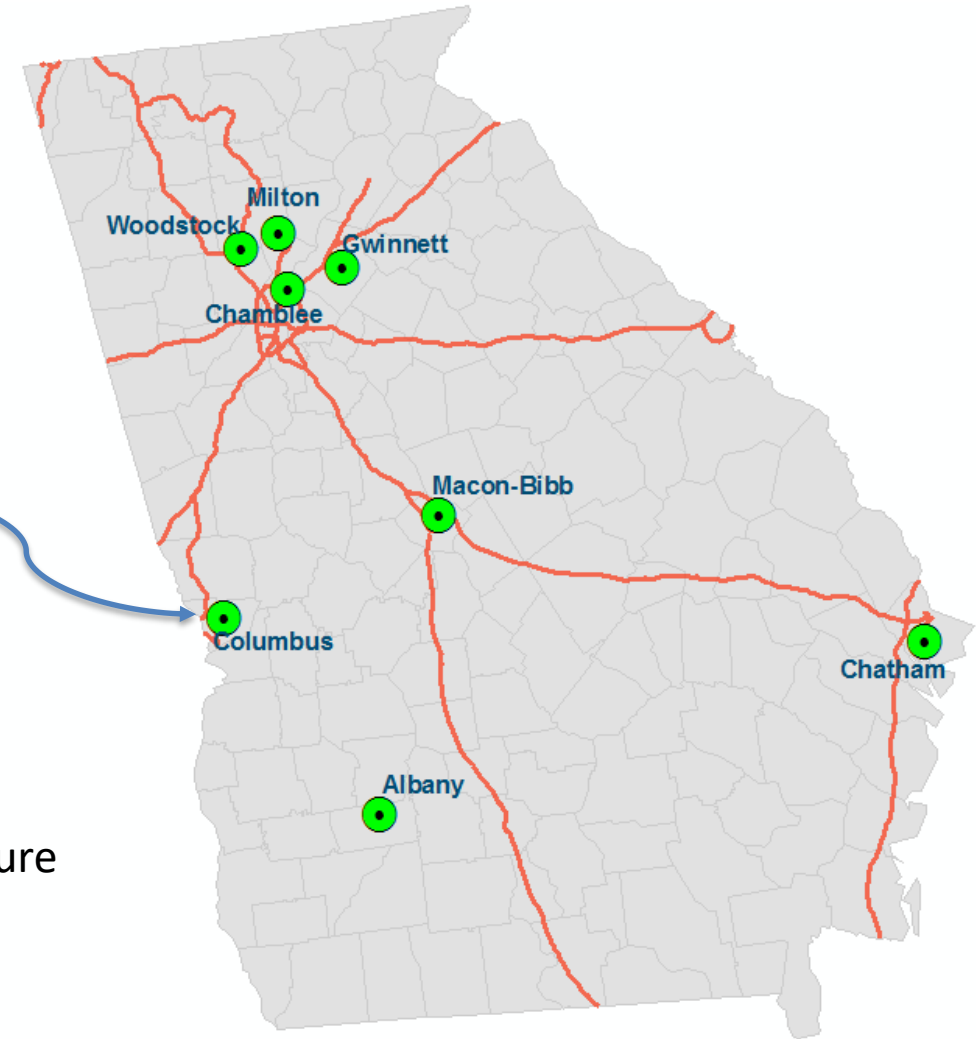


Columbus Consolidated Government, GA



Develop “Smart” technologies for their Uptown district to promote safety, security and an intelligent transportation system through a coalition for data sharing and infrastructure improvement.

(2019)

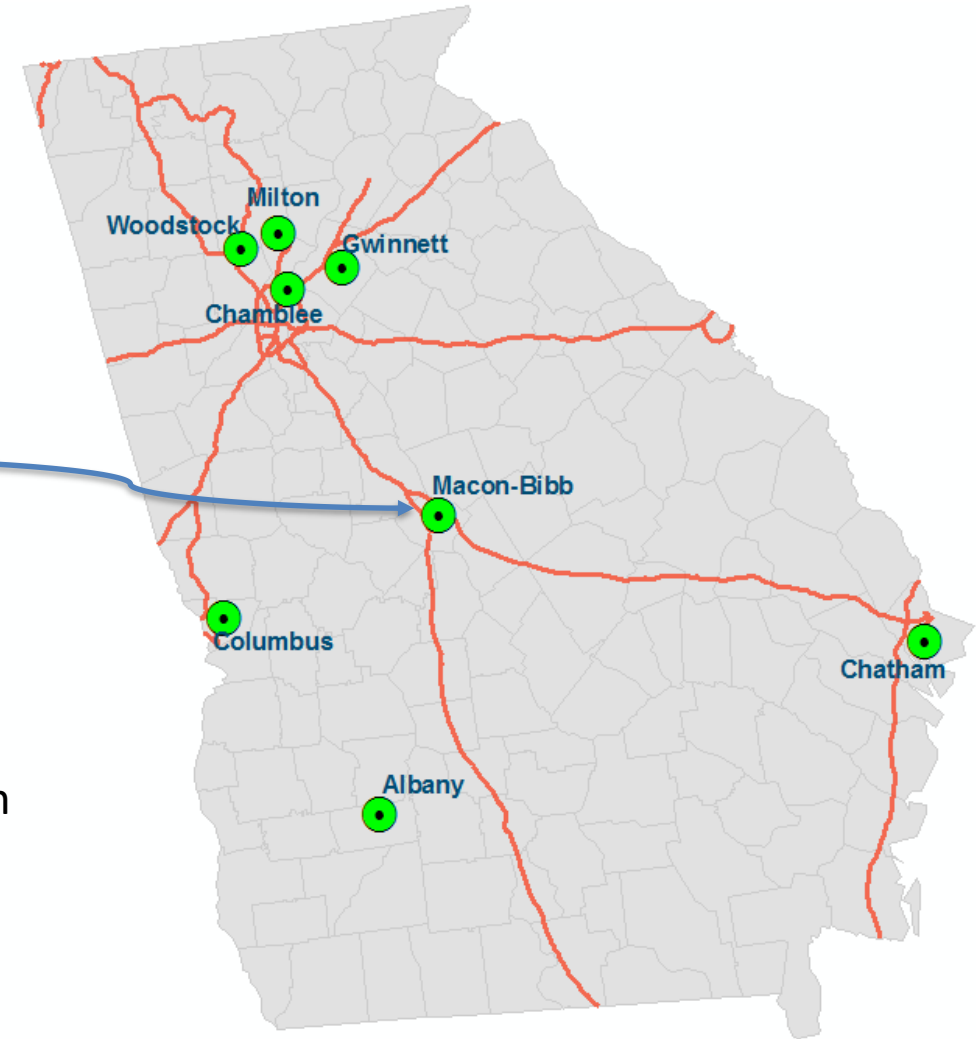


Macon-Bibb County, GA



Develop a Smart Kiosk system to integrate existing mobile applications and smart solutions using a grant funded from Georgia Smart.

(2019)



Milton, GA



Develop a smart-interactive app for smart phones to provide real-time group communication for parents of kids who want to walk to school in a group with other kids, also known as a “Walking School Bus”.

(2019)

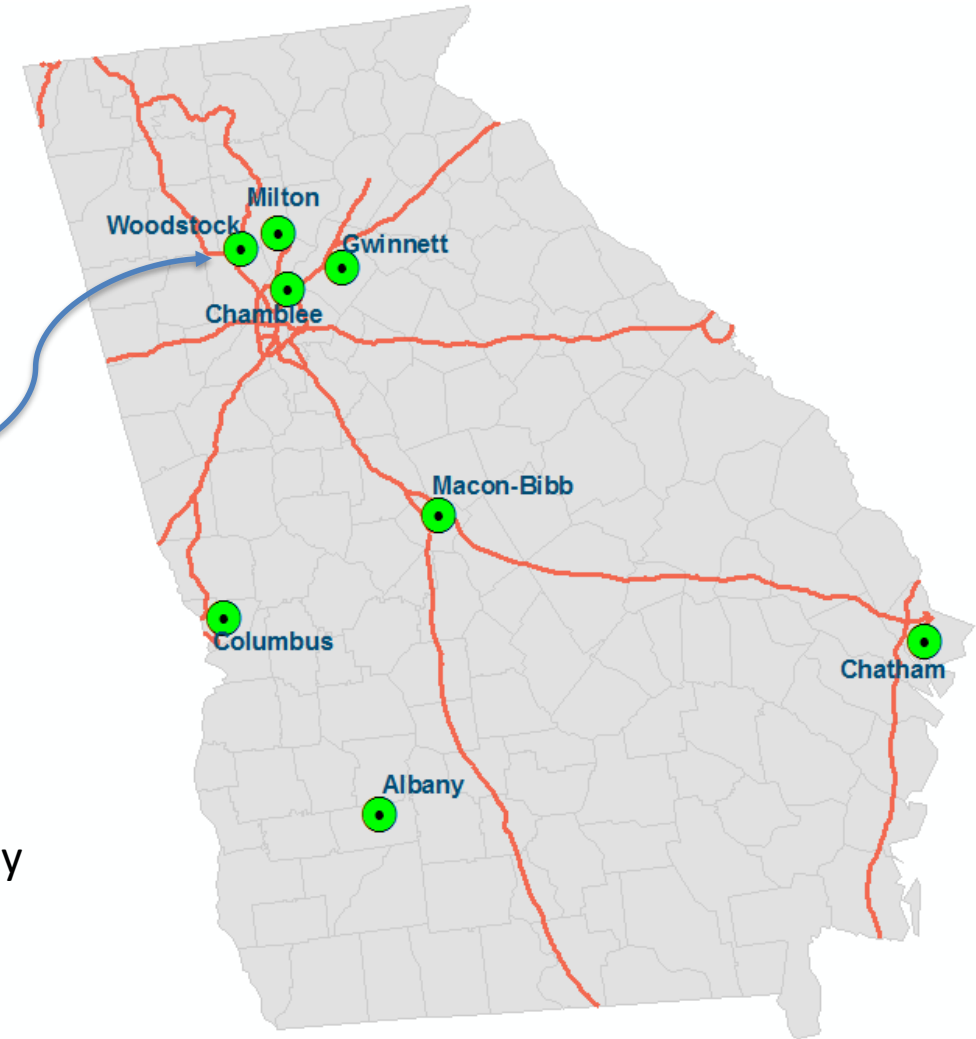


Woodstock, GA



Will develop a Smart Woodstock Strategy and a Smart Corridor Study for optimizing infrastructure needs and modeling land use changes with a goal of enhancing quality of life for citizens.

(2019)



In 2016, Philips Lighting and the Economist Intelligence Unit surveyed over 2,000 citizens and business executives in twelve major cities around the world to assess the progress of cities toward adopting smart technologies.



37%

of citizens are willing to share personal data to **help improve emergency services and reduce crime**



57%

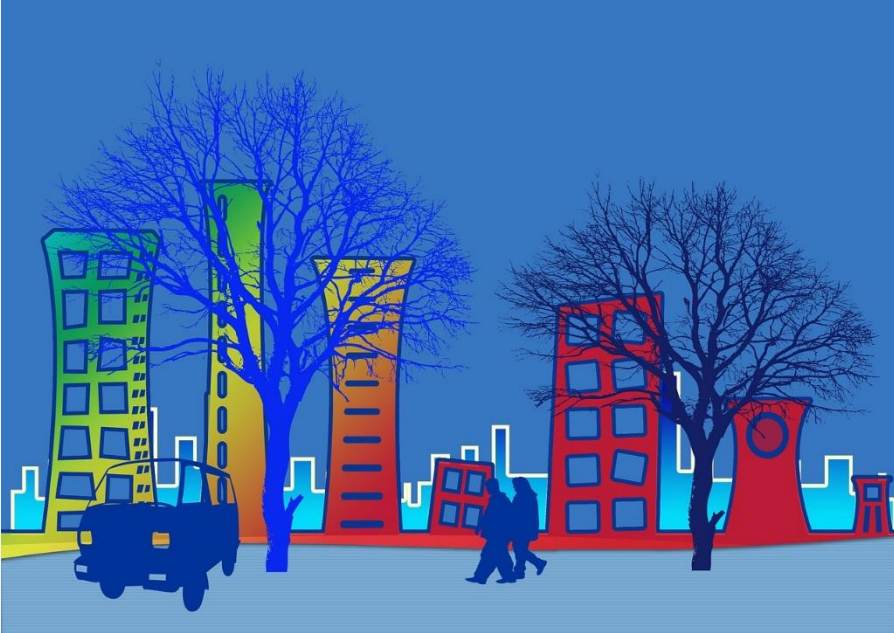
of citizens say that digital information about utility use shared by the government would **encourage them to alter consumption patterns**



63%

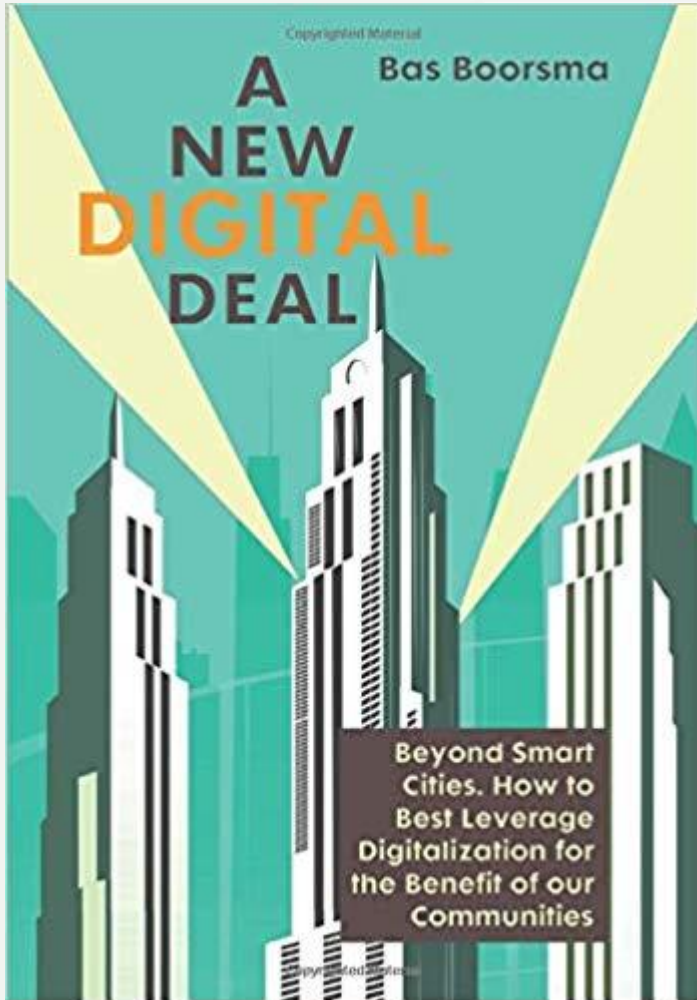
of citizens believe that the government should be investing more in digital technologies that **enable business to play a role in urban environments**

Improved digital technology helps citizens influence urban development



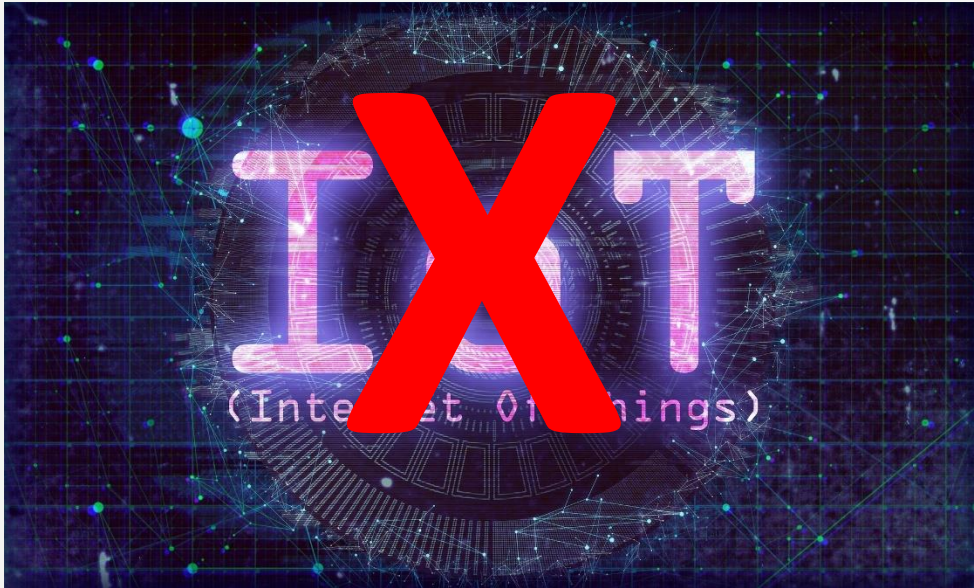
- Sustainability of projects on a long term basis.
- Taking projects beyond pilot studies and scaling.
- Implementation costs and evolving funding models.
- Technology life cycle - endless upgrades to systems.
- Consensus & governance.
- Smart city functions carry the risk of making existing social and economic inequities worse.
- Trust resiliency between stakeholders.
- Broader information security issues.

REASONS THAT HOLD BACK FOR SMART CITY INITIATIVES



- The Game of the Name
- Technology Myopia
- Solutionism
- Lack of Clear Objectives
- Smart Cities as a Matter of Public Sector Procurement
- Stuck in Silos
- No Plan to Replicate or Scale
- Digital Divides and the Lack of Community Communications
- Legacy IT, Sub-optimal Networks
- Top-Down Versus Bottom-Up Dichotomy
- Closed Architectures
- You Must Be This Tall to Enter the Smart Cities Club

"A New Digital Deal – Beyond Smart Cities. How to Best Leverage Digitalization for the Benefit of our Communities" By Bas Boorsma; 2017



- Scattered, local-level resistance by residents to smart-city programs.
- Perceived notions of private agencies profiting from projects using public resources.

For example - Toronto waterfront urban renovation project called Quayside by Sidewalk Labs, a company associated with Google's parent Alphabet.
- Cities have banned specific smart city components over doubts about its accuracy.
- Growing resistance to technology intrusions.
- Stealthy collection of data through video surveillance.



- Cities should find their own definition of what “Smart” means to them
- A Smart City framework must align with a city’s vision and priorities for the future
- Building partnerships among stakeholders
- Efforts must be coordinated rather than isolated
- Clearly established metrics to measure outcome
- Push the envelope / outside the box thinking
- Organizational and governance challenges must be recognized very early

.... If cities are ambitious to envision and implement smart city solutions, they don't have to start from a blank slate - there are successful examples across the spectrum to learn from

.... digitalization will likely become ubiquitous. Failure to recognize the enormous potential of smart city ideas is not an option....

Lead, Follow or Decline

Thank you!