

Smart Cities of the Future: The Desirability of Connected Cities in the 21st Century

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Many of us have looked longingly and probably with a hint of envy, at the annual lists of the most livable cities in America and the world. Places like Austin, TX, Charlotte, NC, Vienna, Zurich, Vancouver and Munich regularly make the cut. Consultancies like Mercer have sliced and diced the data around political stability, crime, media censorship, medical supplies and services, availability of international schools and public transportation¹ down to easily digestible rankings that paint a picture of opportunity and future growth. Moving quickly into the 21st century, it becomes apparent that a city's overall livability

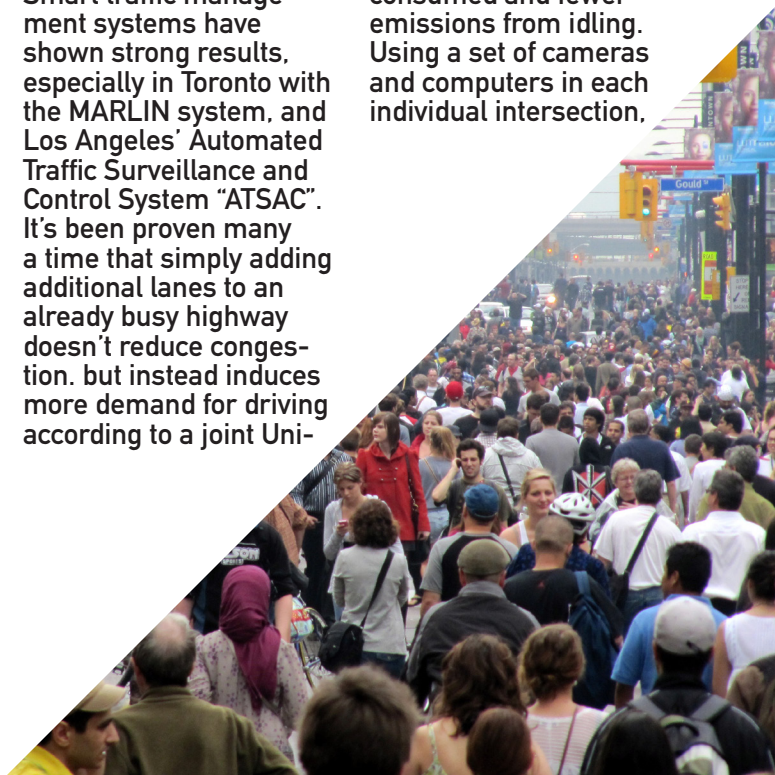
will have to enter a new dimension in order to keep pace with growing populations and finite resources. Technological innovation coupled with smart connectivity that leverages the growing Internet of Things, can solve actual pain points related to traffic congestion, waste/pollution management and energy efficiency that will take city livability to new levels..

Traffic and Transportation

At an MIT sponsored forum on the "Rise of Smart Cities" just this May, audience members were asked to call out an adjective that resonated with the smart city concept. Digital, efficient, equitable and sustainable were the top contenders. To bring those adjectives to reality, policy planners, technology innovators and end-users must work together closely to vet out solutions to age old problems and to do so with a long term

phased approach that builds on existing infrastructure. Technology must be leveraged not for technology's sake but with a focus on real outcomes. In the case of streamlining transportation, there's always room for improvement. When faced with reducing roadway congestion, city planners have additional weapons in their arsenal that complement mass transit and ridesharing options. For the vehicles already on the road, it's about intelligently managing the overall flow of traffic. Smart traffic management systems have shown strong results, especially in Toronto with the MARLIN system, and Los Angeles' Automated Traffic Surveillance and Control System "ATSAC". It's been proven many a time that simply adding additional lanes to an already busy highway doesn't reduce congestion. but instead induces more demand for driving according to a joint Uni-

versity of Pennsylvania and University of Toronto study.² That's why traffic management systems have an even bigger role to play in smart cities. The goal of these systems? To reduce time spent in traffic, reduce emissions, and cut down on accidents. Toronto's MARLIN system, currently in a pilot phase, uses artificial intelligence and game theory to cut wait times at lights and keep traffic moving. Less waiting at lights means not only getting to your destination faster, but also less energy consumed and fewer emissions from idling. Using a set of cameras and computers in each individual intersection,



Toronto's MARLIN uses real traffic data to "adjust the length of the green light accordingly".³ The system is more responsive than typical traffic light networks that function based on timers, or ones that need to link back to central hubs. MARLIN has cut waiting times at lights by 40% which translates into an average of 25% of traffic savings time. With the economic toll of traffic jams in the Greater Toronto and Hamilton areas estimated at \$6 billion a year according to the C.D. Howe Institute, reducing traffic wait times makes big economic sense. In Los Angeles, where grinding traffic is seared

into the consciousness of city residents, the Automated Traffic Surveillance and Control System (ATSAC) first created for the 1984 Olympics has also made good inroads in reducing wait times. Relying on sensors and closed-circuit cameras, ATSAC has been significantly upgraded to provide remote control traffic management capabilities for all of the city's 4,500-plus traffic lights resulting in 12% shorter commute times.⁴

An even more daring and hands-on solution to the traffic dilemma is the eventual use of the SMIDER system. SMIDER is a next generation traffic management system that uses active physical dividers that can move inwards or outwards, in effect increasing or decreasing the number of lanes on a road to enable faster clearance of rush hour traffic.⁵ SMIDER can be overlaid on existing infrastructure and would be far less costly than

new road or overpass construction in its quest to reduce congestion and keep traffic moving.

1 <http://www.cnbc.com/id/102470877>

2 <http://www.nber.org/papers/w15376>

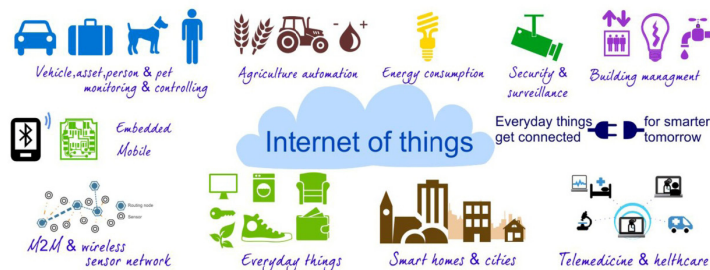
3 <http://globalnews.ca/news/1110364/smart-traffic-lights-could-cut-your-commute/>

4 <http://smartcitiescouncil.com/article/battling-traffic-jams-smarter-traffic-signals>

5 <http://smider.in/solutions/caterpillar-smider/>

devices, sensors and "Things" to facilitate real outcomes through the end to-end digitization of a business process. The sensors that will detect traffic, and intelligently sense what needs to

Internet of Things and Pollution



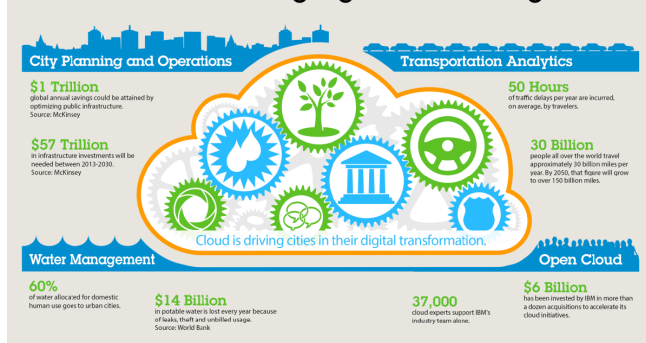
Whether streamlining traffic, or keeping pollution at bay, smart cities will be enabled through the Internet of Things (IoT). This phenomenon leverages the growing

happen next, in order to have a "gate" automatically adjust the flow of traffic in the case of SMIDER, will become a reality through the careful coordination of the

than ever before. The Air Quality Egg (AQE), named a Best of Kickstarter 2012 project, is one such device that is the essential node or

action based on verifiable pollution patterns and how that'll translate into an actual decrease in pollution but it is significant step in coordinated monitoring and business process automation. In an effort that would make any IoT proponent proud, full end-to-end processes for the pickup and removal of trash are already in effect. Needham, Massachusetts based Bigbelly Solar uses a network of smart waste and recycling stations (the nodes of the IoT) along with a centralized CLEAN management console, cloud computing and analytics in order to manage waste removal. The company is bringing 21st

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IoT. According to IDC, the Internet of Things market will reach \$7 trillion in just five years. Despite this, a recent Accenture study found that 73% of companies have yet to make any "concrete investments" in the IoT. According to Dr. Setrag Khoshafian, BPM expert and Chief Evangelist at Pegasystems, "The perfect digital storm of mobile, social, cloud, analytics and connected devices (a.k.a. "Things") is transforming businesses, governments, and consumers at an alarming rate."

If the IoT can help reduce traffic, then more systematic monitoring and control of pollution and

waste levels would be a natural extension of smart business process management. Air quality sensors, working in concert to monitor and even predict trends in pollution can leverage the IoT. With enough sensors at work, patterns in air pollution could be detected, and exception paths activated to either alert authorities to action when pollution levels become unsafe. This type of distributed monitoring would happen on more frequent intervals than centralized monitoring with the ability to detect highly localized trends faster

"Thing" in an air quality sensing network. The AQE detects the most indicative elements related to urban air pollution, Nitrogen dioxide and carbon monoxide and allows users to send the data to an open data service and generate triggers for tweets and text messages. The bigger questions surround how quickly citizens or the public sector can take

century technology to one of the “least efficient and resource-intensive” industries on the planet. BigBelly is today actively managing waste on some of the busiest intersections in the country and bringing clarity to the question of how often waste receptacles should be emptied. Empty them too often, and it’s a waste of manpower and energy, too infrequently and there could be an overflow situation or worse, a health hazard.

6 <http://airqualityegg.com/>

Overall Energy Efficiency

Finally, when you’re actively tackling pain points like transportation, and waste management, how does that translate as a whole into a broader sense of energy efficiency? Energy efficiency is considered the “fifth fuel” and requires “nitty-gritty, a lot of incentives and a lot of regulations - and there’s no red ribbon to cut,” according to former EU Energy Commissioner Andris Piebalgs. It may not seem as glamorous or tangible as other forms of energy but cities like Charlotte, North Carolina are using it to effectively elevate their smart city stature. Along with Duke Energy and Charlotte Center City partners, the City of Charlotte launched the “Envision Charlotte” partnership in 2010. The overarching goal has been to reduce city-wide energy consumption 20% by 2016. Stakeholders from city planners,

to facilities managers to heads of utilities have all been involved in a four-pillar initiative to manage energy, water, waste and air pollution. The program makes use of wireless communication networks and detailed monitoring of energy consumption across more than 60 commercial buildings encompassing 21 million square feet and housing 70,000 occupants. The city’s smart grid captures information using smart meters throughout commercial buildings, routes it across a wireless network, through the cloud into a display in building lobbies where business occupants can track progress. Envision Charlotte also focuses on the low hanging fruit of how and when to turn off lighting, setting back thermostats when buildings are unoccupied and turning “tenants, workers and visitors into project stakeholders.”⁷ As The Economist recently said about energy efficiency, “The cheapest and clean-

est energy choice of all is to not waste it.”

As of 2015, the program has reduced city-wide energy consumption by 8.4%. This translates to an estimated savings of \$10 million. While the city still has a way to go to achieve the lofty 20% savings target by next year, it’s still very much a great lesson in collaboration between stakeholders towards mutually beneficial smart city goals. City livability is much improved when people work together towards a lower carbon future. It’s also a big step towards cost reduction in what end users pay for energy and what vendors charge for it, enabling funds to be allocated



elsewhere for other energy initiatives.

7 <http://smartcitiescouncil.com/resources/helping-city-charlotte-envision-more-sustainable-future>

Conclusion

In conclusion, the major stakeholders in any city or state must collaborate openly in order to decide how livable and sustainable their environment should be. Sometimes the gradual pace of regulatory reform in energy can seem at odds with the faster cycle of technological innovation in the industry. Even more reason then, to make progress through unified teams of regula-

tors, end users, technology companies and advocacy groups that ensure that key viewpoints are heard and program objectives can be met. Smart cities are a work in progress, but cities across the world have a better chance at earning the “most livable” crown when smart city initiatives are implemented with real business outcomes and end-user needs in mind.

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