Smart Cities and its relevance to Mobility

Mobility 2030

1. Introduction

The macro trend of urbanisation that started several decades ago shows no sign of abating, and indeed, in some cases, is accelerating. The densification of cities brings myriad challenges, not least of which is the lack of supporting infrastructure – arguably this is more prevalent in emerging economies than in developed countries where there is a stronger approach to centralised town planning and a robust set of by-laws and enforcement that allows greater control over transport infrastructure in particular.

In addition to urbanisation, a strong driver for increased demand for transportation services is population growth. The United Nations projects that the world's population will grow by 918 million by 2030 and 2.1 billion by 2050 (vs. 2018 figures). The proportion of urban dwellers from 2018 is estimated to be 55% in 2018 and this will rise to 68 percent by 2050.

The demand for transport will obviously increase but the nature, range and cost will vary for different population segments – and cities will increasingly strategise around the best mix of transport services while balancing efficiency and environmental considerations. A multi-modal transport portfolio will play an increasingly important role in future. However, it is also clear that there will be a tipping point where transport infrastructure will be unable to adequately meet demand for timely, efficient and cost effective transport solutions.

Adding the changing patterns of attitudes towards transport ownership introduces a further dynamic which also has to be taken into consideration when developing an appropriate city transport solution.

The growth in emerging technologies shows promise for solving new challenges in transport management. The convergence of services has led to new models of transport combined with other goods and services, e.g. ride hailing morphing into a food delivery solution (Uber Eats), dynamic parking solutions, peer to peer traffic management (Waze). Other examples include algorithmic based technology for congestion management, increased connectivity of cars with fixed assets like buildings. Similar solutions lead the way in the digital transformation of cities to efficiently provide energy, transportation, resources, employment and other services to its residents – this transformation has resulted in the development of "smart cities".

2. What is a smart city?

A smart city is one that collects and analyses large amounts of data from a wide variety of sources which could include specific transport related information like traffic data and combining this with other types of data, like weather conditions. It connects a network of hardware, software, sensors, devices and human input (e.g. social media) to deliver an efficient transport system – ultimately for the benefit of its residents.

3. Smart cities are technology enabled

Technology is the fundamental underpin of smart cities – it is both an enabler as well as a key driver for innovation solutions. A second aspect of smart cities is strong collaboration between different service providers – this includes software companies, government, telecommunications and the financial sector. It is now technically possible for an autonomous vehicle to find and pay for parking by itself. Imagine ticketless biometric payment through train or bus turnstiles by facial recognition (virtual passport control has already been implemented in some countries through iridial biometrics).

Smart cities use multiple technologies that extract data from a large array of physical devices (which may be fixed or mobile). Sensors are already ubiquitous in existing locations like traffic lights, street lights, street cameras, parking meters as well as citizen assets like motor vehicles. Virtual sources of information like social media will also need to be integrated into smart transport solutions. In fact, during recent natural disasters, social media was far more effective in informing formal disaster management relief efforts than the authorities themselves.

Clearly, Internet of Things (IoT) technology will play a huge role in providing large amounts of data while data analytics companies will analyse the "big data" that is generated to provide inputs into specific software solutions. The ICT sector will be instrumental in dissemination while the GIS (Geographical Information Systems) will allow full analysis at every location. Collectively, it will be possible to analyse traffic patterns, predict congestion, and provide immediate intervention, all in real time. Of course, smart city technology is not confined only to transport systems but to the entire range of services, e.g. management of utilities such as water and energy. As an example, a burst water pipe on a road could lead to instant modelling of predicted traffic patterns and could be relieved by changing the timing of other traffic lights while advising motorists to take two different alternative routes, which otherwise would cause congestion elsewhere.

Artificial intelligence shows great promise to dynamically manage transport patterns, e.g. learning when peak periods are and what drives these – ultimately resulting in personalised traffic routes per motorist at certain times and days, while collectively minimising travel time and cost.

4. Smart transport systems

The movement of goods and people is continually increasing and needs to be continually optimised while balancing its impact on other factors such as the effect on the environment, cost of implementation, etc. Several elements of smart cities are directly transport related:

4.1. Traffic management

Congestion is arguably the source of the most frustration for motorists while also increasing costs and decreasing personal productivity. Waze, which is a peer to peer traffic management app, has been phenomenally successful in optimising routes for motorists by leveraging their location and speed in real time. A smart city would extend this concept to all motorists (not just those who download the Waze or similar app) – by providing sensors on every vehicle.

By combining data from other sensors (like street cameras), a holistic view of all traffic related information can be analysed to direct different motorists to the best route that will both individually reduce their travel time and collectively prevent traffic congestion.

4.2. Parking

The limitations of physical space in cities reflect the challenges of parking which has several implications – lack of productivity since time is wasted looking for parking, the wasted cost in fuel, the impact on carbon emissions and finally the contribution to congestion.

Data from sensors can now map out the availability of parking spaces and aggregate this data to produce a city wide instant view of parking availability that is available as a downloadable app for motorists.

Several smart parking solutions exist with different benefits, e.g. differential pricing, full view of the total cost of a trip, integrating parking with traffic management, automatic remote payments based on time spent at a parking bay.

4.3. Ride sharing

Ride-hailing services such as Uber and Lyft have expanded exponentially globally and will become an integral part of smart cities. One significant implication is the decrease in, or at least a slowdown in the rate of, vehicle ownership. Since these services are naturally connected, it provides a rich source of data to map traffic patterns and passenger behaviour. This transport model also alleviates pressure on parking while also combines trips with different aims, e.g. sharing rides with food delivery.

4.4. Multimodal transport

Smart cities will enable the aggregation of multiple data sources of transport to efficiently allocate the mix of transport modes, e.g. public transport, private vehicles, bicycles, pedestrians, rail. Many of these modes act independently of each other with no data sharing between these. Therefore it become difficult to aggregate this data to create efficiencies – an immediate opportunity would be to create a shared data platform for each of these modes at least in real time. The true value of this data will lie in its predictive ability to determine the optimal mix of modes to address congestion, cost, emissions etc. The addition of new forms of transport will also need to be integrated, e.g. drones.

Multimodal transport has specific relevance to emerging economies which are characterised by inadequate public transport and a large informal sector of transport operators. The challenge is to be able to extract data from participants outside the formal network - either through mobile apps or sensors (e.g. to embed sensors into annual renewal of licence discs).

4.5. Public services

Anecdotal information around recent natural disasters demonstrated the positive effect of social media on emergency response services. Similar effects play out for other incidents such as traffic jams (Waze) as well as accidents. Smart city technology that integrates with the transport system could cut response times by optimising routes, changing street light timing, redirecting traffic elsewhere etc. An example of a benefit at a low level: a simple solution would enhance the current system of audible sirens asking motorists to clear a path by informing them long before a siren is heard.

5. Risks of smart cities

As much as smart cities hold promise for a clear and more efficient system with multiple benefits for its residents, there are significant risks associated with technology enabled infrastructure. Since data from physical and virtual sources is at the heart of enabling smart cities, much of this is consumer information. Such data has to be treated with general principles of transparency and privacy protections.

Cybersecurity is a crucial element of smart city functioning. The ability to hack just one system could create havoc, e.g. if street light timings were changed or parking solutions indicated more vacancies than there were. Theft of data and misuse of that data could cripple the city, akin to ransomware.

6. Conclusion

Smart transport systems are an essential part of smart cities which enable the efficient movements of goods and services. The rise of smart cities will continue globally to meet the demands of an increasing urban population while minimising the impact on its environment. The nature of these cities will be different depending on its size and location as well as meeting its local social challenges. Since the largest stakeholders including government, civic organisations and business have a vested interest in creating a sustainable future, it is expected that smart transport systems will continue to evolve in imaginative ways.

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