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LuxTurrim 5G

Building key enablers for a Digital Smart City

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LuxTurrim5G - Building key enablers for a Digital Smart City

LuxTurrim5G is developing and demonstrating fast 5G network based on smart light poles with integrated antennas, base stations, sensors, screens and other devices. This joint project opens new digital services and business opportunities for a real smart city.

Future smart city landscape

The role of cities keeps growing. Many factors are contributing to this evolution including the population migration to large cities, the higher specialization and innovation among dense population, and the critical mass for new service paradigms based on digitalization. The growing importance of cities promotes inter-city competition on national and international level. City leaders are becoming increasingly aware of the need to design the fast transformation of infrastructures, processes and landscape in a holistic, multi-disciplinary and sustainable manner. A successful city needs to continuously develop its attractiveness and efficiency as a whole while navigating through the complexities of urban digitalization. This can be seen as the international race toward the "smartest city". Using the maturity modeling terms the race is about climbing up a 5-step ladder from "ad hoc" toward "optimized" where the city management ultimately has a full sensor-based visibility to all necessary parts of city operations as well as real-time control allowing optimization.

City is a natural unit of design with its geographic, demographic, and legal boundaries. Many cities already have an integrated and holistic approach to city design but one important component – telecommunications - is still largely ignored. Especially radio base stations, which are the naturally visible part of the telecommunication network, often emerge as an afterthought in the city landscape when developed incrementally by competing and poorly coordinated mobile operators. Considering the continuous fast growth of wireless Internet usage and the emerging new smart city applications such as smart traffic control, smart lighting (including LED technology), self-driving cars and air quality monitoring, even keeping the achieved smart city maturity level is challenging. However, even for the leading smart cities this evolution means uncertainties that need to be managed carefully. Digital transformation involves steps toward higher levels of automation. Each step may appear as a small digital disruption where some stakeholders win while some may lose. How to manage these disruptions? When is the right time to take the next step? How to assign roles, public and private, and which are the best business models?

To manage the uncertainties and fast innovation on the smart city application layer, cities need to secure the availability of the underlying infrastructure on the right spots, especially electricity and communications. If not well planned, these infrastructures may create harmful timing bottlenecks due to heavy investments and potential legal hurdles. In order to make the transformation to the new generation smart city infrastructure possible, proof of concepts is needed to test the technological opportunities and economic feasibility of the future smart city digital ecosystem.

Our society and cities face great challenges to improve safety, energy efficiency, air quality, effectivity of transportation, and quality of living.

A new generation digital ecosystem is needed for smart cities to enable:

- Development of new smart city infrastructure and services
- Improvement of city infrastructure maintenance
- Improved data capacity for citizens
- New service and business opportunities for companies
- Opportunities for new micro-operators in the systems
- One common flexible total cost optimized high capacity 5G network

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Effective communications networks needed “as a nervous system” for digital smart city

The key challenge

The capacity of mobile networks will be far too insufficient already in a few years due to increased number of users and new digital services built and planned. This creates a serious bottleneck and threatens realization of the important smart city digital services which are vital only if they are connected and distributed through an effective and reliable telecommunications network. This problem can be solved only by taking into use small cell RF technology and higher frequencies.

New mobile network with 5G macros below 6GHz frequencies gives enough capacity for a couple of years. Higher frequency air interfaces are needed as soon as smart city data traffic increases because of surveillance cameras, 3D-streaming and other data hungry services. High frequency enables high data capacity but the high frequency signals span only short distances, which means that a lot of small cells are needed.

To deploy small cell every 50 meters is a huge challenge for mobile operators. One way to solve the deployment is to start to use the light poles for 5G small cells. Light poles are located normally 40-50m distances from each other and are often owned by the city. To combine the smart city needs and the mobile operator deployment challenge by using city owned light poles as a site for 5G radios sounds logical. City would need to support the light poles also with constant electricity and data network (fiber). There is no place for many 5G small cells in the light pole so mobile operators need to share the same and only network. Sharing of course also reduces the cost challenge.

Co-operation between city and mobile operator is needed albeit current mobile operators and smart cities may have different needs for the network. Cities use the network as a platform for their digital ecosystem and to increase the quality of living for their citizens. Cities often like to share all data openly to get the digital ecosystem flow.

LuxTurrim5G will make it happen!

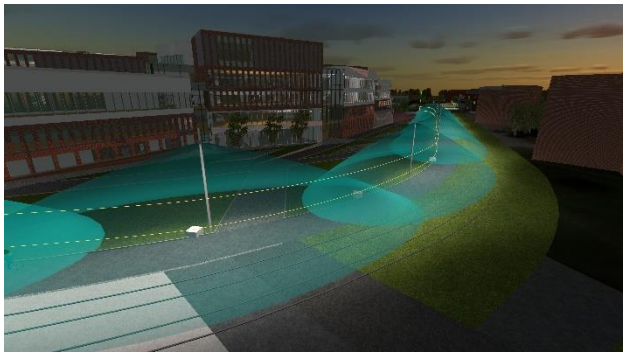
LuxTurrim5G consortium brings a solution that helps smart cities to serve their digital ecosystem and citizens by data transfer platform using 5G small cells integrated to light poles. The consortium uses composite-based light poles with integrated 5G radios, wireless backhaul, video cameras, air quality, weather and location sensors, and of course the intellectual LED lighting. These are example equipment to enable and showcase some lucrative services. All the data of the platform is connected to the 5G edge computing, which may partly be located even inside the light pole. Naturally, the open platform supports other sensors or actuators, as well.

The small cell service platform will bring virtualized computing environment to the edge of the 5G network. Distributed 5G core cloud will enable easy and secured access to the 5G light pole infrastructure for different local and global service providers.

Mobile networks signal penetration to buildings has challenges with new zero energy buildings.

The solution - LuxTurrim5G

LuxTurrim5G will develop comprehensive technical solutions, new digital services, and infrastructure for smart light pole based 5G network and create an ecosystem solving the critical challenges of future smart cities.



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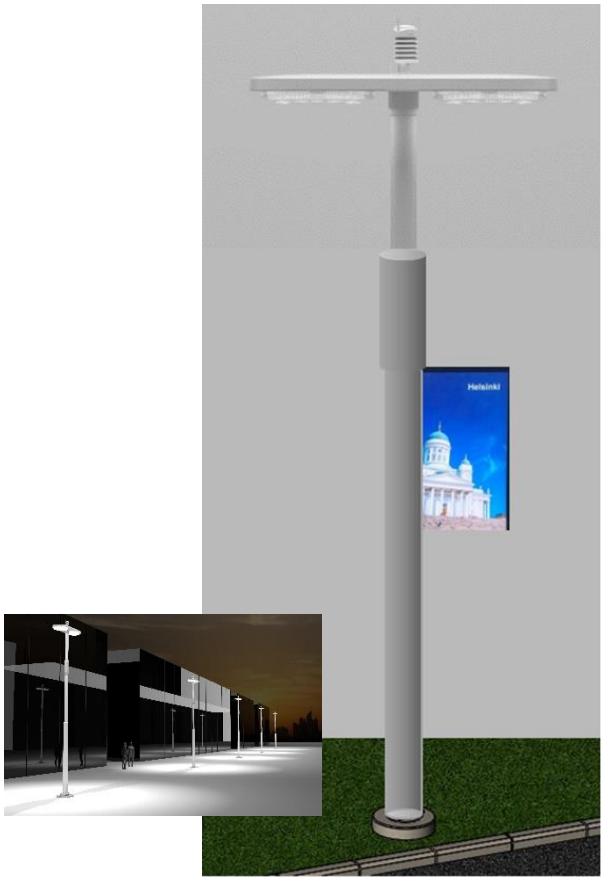
The challenge will even increase when higher frequencies are used. LuxTurrim5G will enable 5G signal penetration by using new window technologies.

To help cities to plan, build and maintain the 5G light pole infrastructure, LuxTurrim5G will include 5G small cells in modern 3D urban city modelling and planning tools.

LuxTurrim5G partners

COMPANIES:
Nokia Bell Labs: 5G radio technology & test network
Exel Composites: light pole mechanics & composites
Premix: specific materials for antenna radomes
Sitowise: 3D modelling & practical city planning
Teleste: low maintenance displays & CCTV cameras for security & infotainment
Vaisala: air quality and weather sensors & monitoring
Indagon: Location services, autonomous mobility
Lammin Windows and Doors: Special windows, RF signal propagation through building materials
Spinverse: project preparation & management

RESEARCH PARTNERS:
Technical Research Centre of Finland (VTT): 5G RF technology, navigation, business and service opportunities
Aalto University: thermal management, business opportunities, 5G radio signal measurements
Tampere University of Technology (TUT): light pole design & materials, 5G signal penetration to buildings



Example of a smart 5G light pole concept with integrated camouflaged sensors and active screen.

Conclusions

Smart cities need effective communication networks to provide necessary digital services enabling security, energy efficiency, effective transport etc. These can be realized and scaled up in a feasible way through the LuxTurrim5G concept - 5G small cells integrated to smart light poles.

The new digital ecosystem of smart cities requires open interfaces and data access for different stakeholders and service providers. To make the transformation to the new generation smart city infrastructure possible, we need proof of concepts to test the technological opportunities but also economic feasibility of new digital services.
LuxTurrim5G will be the breakthrough enabler for a digital smart city ecosystem in street level deployments, building versatile technology and service platform utilizing 5G technology as a single flexible network. As an outcome, the project brings big data capacity available and provides an open access platform for new digital services – both technology and business-wise. The solutions related to the 5G small cells integrated to smart light poles together with selected sensors and related services will be demonstrated and the business base for these products and services will be created.

Through the efficient smart light pole network LuxTurrim5G makes the cities smart – in a street credible way!

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