D!CITY

2/2019

For Creators of Smart Cities

CITY PERFORMER
How Is Your City Performing?

The End
of Traffic Collapses

Michal Kaliňák
"The Will to Be Smart
Is Not Missing"

Cameras with AI
The Smart Eyes
of Smart Cities

5G Fifth Generation Networks

Content

DiCITY For Creators of Smart Cities
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Vladimír Levársky, CitySys
3 min

The Heart, Head and Skeleton of Every Smart Solution Will Be Technology

Challenge Accepted

When we look at successful Smart Cities implementations, we observe and evaluate them mainly from the end user's perspective. What we don't see at first glance is the back end of the whole solution, its skeleton and brain that hold it all together and control it. It is precisely the core and the basis upon which a comprehensive smart city implementation will be carried out, in which most of the attention needs to be paid to it from the beginning because the municipalities and their inhabitants will only benefit from it if the foundations of a smart solution are solid.

Preparing our cities, villages and regions for a transformation process is a challenge that we have accepted as our personal responsibility. While developing a complex smart city solution, we have followed a simple thesis that attaches a crucial role to the well-built IoT architecture of the CitySys platform, which is the smart city's technological heart and the first prerequisite for the successful implementation of smart solutions. The way we thought about the CitySys solution from the beginning and eventually built it could be summed up in the following points, which we also consider to be a set of necessary steps in the transformation process of every single village about smart.

1 The platform's IoT architecture is a prerequisite for implementing smart principles.

2 IoT platform architecture must be secure, robust, absolutely open, ready for all new technologies over time, pro-integration and interdisciplinary.

3 All existing elements of communication (power line, RF, cellular, etc.) must be respected and assumed.

4 Interdisciplinarity at the lowest level of the platform is the foundation of a successful Smart City project and is essential for artificial intelligence elements.

5 An ideal infrastructure for implementing smart city solutions is a public lighting network, without discussion or being demonstrated.

6 Creating an ecosystem of services will provide an intelligent city with a unique and fixed key organisation.

7 The next step is to prepare the City Dashboard (Digital Twin City), which allows collecting and visualising information from different city systems (such as parking, safety, waste management or lighting management) in one place.

8 City Dashboard should be a clear, user-friendly environment in which the authorised authority(s) will be able to perform a series of operations (monitoring, controlling, KPI tracking, ROI, etc.)

9 Everything in one place is a basic premise and the reason for the existence of a single City Dashboard (partial IoT devices will not provide a comprehensive, unified overview, lacking an analytical module and interactivity).

10 The unprecedented and unlimited openness of the platform and the accessibility of the source code accelerates ecosystem creation and completely leaves the management of the smart city to governments.

Whatever the holistic outcome of the transformation process may be, its head, skeleton and heart must be technology.

Smart Cities are responding to all the civilisation, social, economic and environmental changes we are facing or will be facing in the foreseeable future. For everyone who takes responsibility for implementing a smart solution, it is now important to understand that, whatever the holistic outcome of the transformation process, its head, skeleton and heart must be technology, or more precisely, a well-built IoT platform.

A Competitive Slovakia Must Be Smart

It's Time to Ask the Right Questions

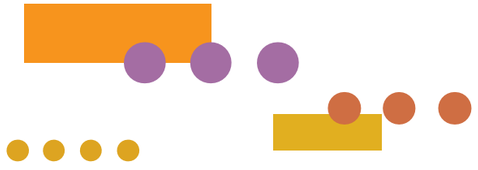
The idea of building smart cities is as old as humanity itself. At present, it is mainly about the sustainable development of society and communities, which is supported by information technology, artificial intelligence and available infrastructure.

Eduard Kačík, Lightech

9 min

The Central European region is undoubtedly facing a period of change. Every change brings with it the difficulties that arise from established behaviours. What is important, however, is that changes also bring opportunities that we can use to further develop ourselves and accelerate our adaptability. Undeniable changes are taking place in the natural climate and in our local environment. Information technologies, mobility and virtual reality bring changes to our everyday lives. Changes are occurring in social life. And we all want to have a better life and health without affecting the existing security and safety.

After its founding, Slovakia, looking for its own development path and single-generation change, came to the point of realising that it needs to change people's education, caring for the elderly and sick, caring for water, clean air and soil. Obviously, we need changes in the approach to the state's planning and management. Changes must also undoubtedly occur in the attitude towards building and managing the country's public infrastructure. In order for all these changes to become an opportunity for a large number of people, we must have enough objective information, the ability to make the right decisions and to act. The amount of objective real-time information depends on the scale and quality of energy, information and technology infrastructure. The ability to make the right decisions and actions mainly depends on people's level of education and general knowledge. At present, both areas deserve more attention and interest from all of us to build them with a new approach and to use new tools.



Lessons from the Past

History repeats itself cyclically. I have the impression that the Central European region is in the same social context as in the 1920s, especially as regards creeping stagnation in education and the development of the country's public infrastructure. Today is the right time to ask whether we are ready to deploy modern information technology and whether we will be able to use it functionally and fully. The introduction of IoT technologies will result in increased demands on the quality of public infrastructure and public services. Public services will only be as reliable as the data, energy and road infrastructure are reliable.

By extending the use of IoT technologies, collecting data and extending the connectivity of millions or billions of devices, we will increase the demands on the existing data metallic and optical networks as well as power lines and power sources. There will be a very similar situation which we are currently in with roads, that is, we can expect collapse and congestion. Virtual reality games, mountain walks and castles will be interrupted, in video-conferences we will ask whether and what we have really heard from the debate, and finally we will be left without electricity because we have not agreed with colleagues as to who will use the rendering server before BIM and 4D documentation. Expensive end devices will make no sense and become useless. Indeed, this dystopian scenario can be fulfilled if we do not ask the right questions today. One of the most important ones is definitely whether we plan to prepare a sufficiently robust data and energy transmission and storage infrastructure and whether we plan to educate smart, perspective and independent people who will be responsible for this infrastructure and technology.

Social changes after 1920 brought a lot of good and bad things to the life of Czechoslovak citizens. The fact remains, however, that it was easier to adapt to social changes for those who planned their personal development and the country's development as well as built it on direct responsibility. Examples of this attitude have always been Tomáš and Antonín Baťa and their approach to everyday challenges and problems, which have been incredibly successful and were quickly solved by common sense. As was the case with the automobile, industrial, aerospace and road and energy infrastructure, it is now a quality and affordable data infrastructure - optical lines, data storage, local power sources and local power distribution. In addition, like today, one hundred years ago, the greatest social problem was the lack of manpower, especially in the younger age category, which lacked the right patterns and vision for meaningful self-realisation. Therefore, the 1940s brought misery and suffering. Thanks to this knowledge, it is now important to realise the importance of smart Slovakia.

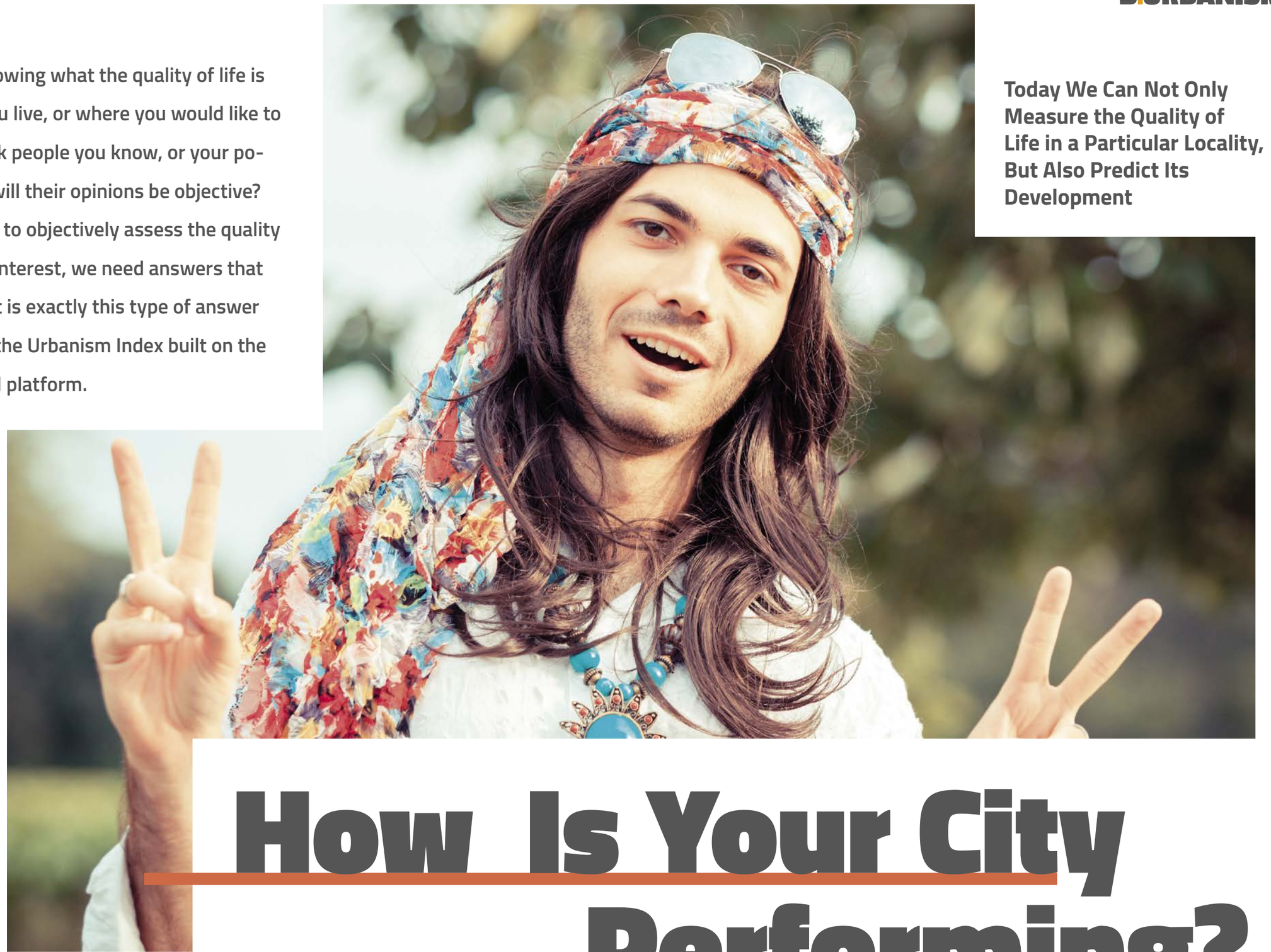
If we want to show that we have somehow learned from history, then we all have to become „smart" in some way. It is only in this way that we will be able to understand the concept of smart cities, how to build them and how to live in them. The essence of implementing smart technologies is not only in the technologies themselves. It is mainly in people's general education and in the level of their literacy in the use of technology for their development and the environment in which we live. Thanks to information technology and social networks, everyone can access, work, critically explore and develop with sufficient information. As never before, we can also participate in decision making. That is why responsibility and the role of building a smart Slovakia is not only within the competence of the state, mayors and representatives, but it is also our common task. We all can think together about big things and small steps to start ourselves. It is enough for each of us to look every day for what we can do differently and better than we have been used to. The key prerequisite for a smart city is and will always be people with positive thinking. Such residents will have a self-government that will set an example.

The creeping stagnation in education and the development of public infrastructure reminds us of 1920s. We must prove, that we somehow learned from history.

New Challenges Define New Demands

Therefore, let's start with a realistic vision of where and how we want to progress. Every city, village and community have their own specific problems. There are many different definitions of a smart city and no two implementations are exactly the same because they have different urban, social, economic and other goals. Therefore, at the beginning, local governments need to generate the public debate and then clearly explain their own definition of what they need to become smart. Exactly how it happened almost 60-100 years ago in Zlín or Baťovany - Partizánske or in Svit. Engage in the people's process and let digital equality in data and technology access be a sign of the current transformation process. Community involvement is key. Digital equality, end-user education, access to technology, field trials, continuous feedback from the population and their awareness are essential preconditions for successful implementation. Another is infrastructure. We will need our own broadband IP, Internet infrastructure and a reliable energy network. We must also accept the domination of data as the only objective basis for correct decisions. Open data is the basis for open government policies. Public data and information from the government and other sources can help solve civil problems and create new business opportunities.

Most importantly, however, we will have to take the initiative. When we look beyond the western borders, we see that there is no room for waiting-and-seeing or transferring responsibilities to the next term of political office. If we want to develop on a sustainable basis, we must not miss the train. Let's support the development of a range of initiatives, such as smart transport, smart energy or smart home programs, which are used by industries and applications. We need to stimulate ecosystems and coordinate the cooperation between them as well as between the state, entrepreneurs and municipalities. We need a culture of cooperation. We need to set specific milestones and look for new criteria to measure them. We need to include new parameters, such as digital economic growth, sectoral sensorisation, the availability of open data, reception of digital services and the like. The sooner we are able to implement smart technologies and develop digital public services in municipalities, the more effectively we will operate processes at the local government level and help them generate resources for new self-development. Being smart has never been an end in itself, nor a manifestation of vanity from a lack of incentives. The changes that are taking place today at all levels of our lives are the result of development and we must respond to them. A competitive Slovakia with sustainable quality of life and development simply must be smart.



How Is Your City Performing?

Today We Can Not Only Measure the Quality of Life in a Particular Locality, But Also Predict Its Development

Are you interested in knowing what the quality of life is like in the area where you live, or where you would like to live? Perhaps you can ask people you know, or your potential neighbours. But will their opinions be objective? Probably not. If we want to objectively assess the quality of life in the area of our interest, we need answers that are based on data. And it is exactly this type of answer that can be provided by the Urbanism Index built on the CITY PERFORMER digital platform.

Pavel Vokáč,
CITYTHINKING, SCII

8 min

Quality of life is generally defined as the subjective assessment of one's own life situation. But as we move away from the subjective perspective to the environment in which we live, work or create, we soon find out that other factors enter in, such as safety, the environment, availability of basic services, mobility, noise, development of transport infrastructure and many other indicators, which by their very nature exceed the limits of subjective perception. This set of factors, plus many more, tell us about the quality of life in the locality's exterior, the one we inhabit or move around in. If we want to objectively assess the quality of life in a city or city district, we need a tool which can evaluate it comprehensively, on the basis of other factors than subjective attitudes and assumptions. It is for just this reason that we have developed the unique digital platform called CITY PERFORMER - and one of its specific outputs - the Urbanism Digital Index, which evaluates the quality of life in a selected locality based on data.

If we want to objectively assess the quality of life in a city or city district, we need a tool which can evaluate it comprehensively, on the basis of other factors than subjective attitudes and assumptions.

The CITY PERFORMER Platform

CITY PERFORMER (CP) is a comprehensive platform that monitors, collects, analyses and evaluates data into predefined categories using superstructure algorithms and compiles them into a comprehensive organised index. These data then inform about the quality of life in the monitored locality, taking into account and benchmarking other localities or cities. The parameters of interest are, for example, data on traffic density, safety, dust concentration, allergens, noise, the availability of services, sports facilities, green areas, and the like. Each of these is assigned a certain weight expressed as a percentage.

For the collection of data, it uses device resources in the IoT system, such as various hardware-implemented sensors in public lighting fixtures, from which the data goes to the database and is then processed together with previously defined data from other public sources such as information from mobile operators or open source platforms.

Given that many of these data in the CP platform are real-time data, the Urbanism Digital Index, as one of the specific outputs, always provides a current evaluation of the level of the quality of life in the monitored locality. And this is of interest not only to private individuals who are considering purchasing real estate, investors, developers or real estate agencies, but also to all the municipalities that depend on positive demographic developments and satisfied citizens.

The Urbanism Index

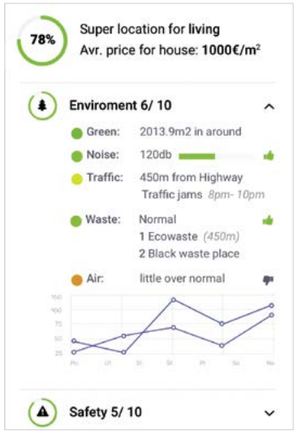
If we present the CITY PERFORMER platform as the central brain of the solution, the Urbanism Index is one of its outputs, or user applications, where the digital data, the digital image of various urban functionalities, is available. Imagine CITY PERFORMER as a digital twin of your city or town, which provides you with a comprehensive overview of exactly what, when and where things are happening in it. CP converts the real world into a virtual one and enables us to model various scenarios, transforming an analytical model of data processing into a predictive one. If, for example, you are interested in what the impact on the quality of life might be for constructing a new multifunctional building in the city centre, CP will show you this in one of its professional outputs, and warn you in advance about any errors in key functionalities or the negative impacts of upcoming policies and strategies on the urban ecosystem. It also enables you to create various other test and decision scenarios with multifunctional KPIs.
The digital twin takes into full account the dynamics of settlement development (changes in the urban space) and reflects social interactions such as demographic data, social influences and specifically supports the 'citizen at the centre of attention'.

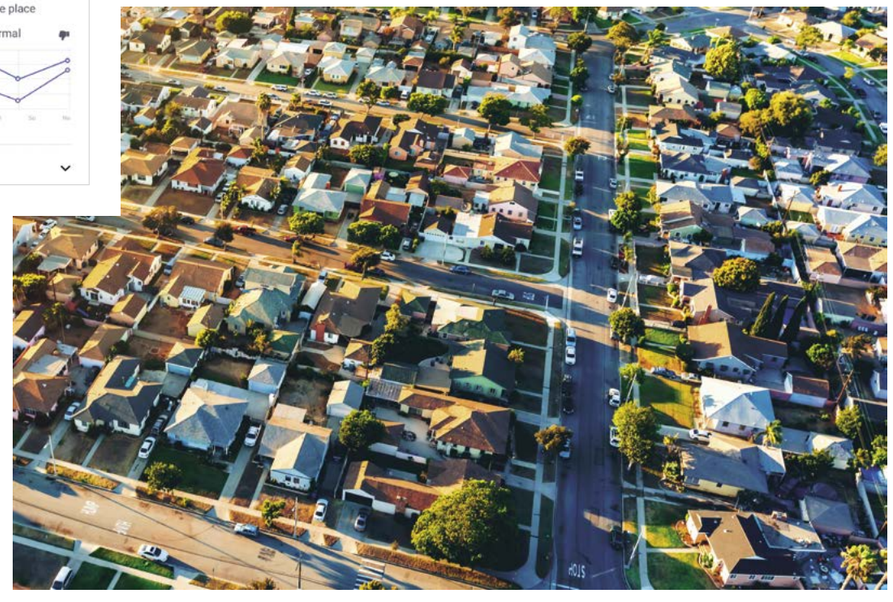
The key pillars of CP are data, information and knowledge across 6 integrated virtual spaces (categories):

- environment,
- space for living/residential areas,
- security of urban space,
  availability of services,
  availability of leisure activities
- mobility - here we mean primarily a preference for sustainable public transportation (yes, at the expense of appropriate streamlining/suppression of individual car traffic).

The Urbanism Index is then proportionally balanced and spread out as a numerically expressed index of the quality of life in the observed space, in our case the city - or more precisely - its digital twin. The identity of groups is supported by generally accepted patterns of behaviour and needs, including specific filters such as youth, families, 55+, all of them complemented by possible individual and more detailed access to data and knowledge in 6 separate interest categories. Here, users can select more detailed personal preferences (for example, safety or the environment).

City Performer, in its functionality, is simply a powerful data analyser, a single platform data and information integrator. It has a clear and intuitive interface on mobile, laptop or other hardware according to personal or professional preferences.





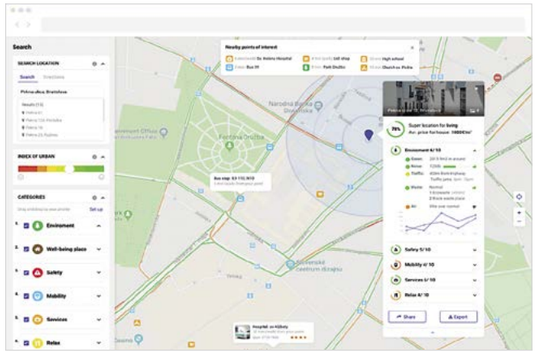
Why Do We Need CITY PERFOMER?

The question ‘why?’ is qualitatively different than the questions who, where, when, what and how...The model of why is our paradigm, a pattern of thinking, the application of vision and knowledge as to how to pursue beauty with common sense, in context analysis, in the adaptation of new digital technologies; it is a sign of respect, an effort to improve the environment and to search at last for an understanding with both the creator and user of the urban ecosystem. It is the answer to where we are headed.

There are a number of applications that provide data, partial data or partial historical information, usually online or on demand. However, the digital space, replete with the transition of information to knowledge by the use of AI principles and links to the lives of citizens, has opened the way to higher quality: from data to information and, ultimately, to more general knowledge, understanding the ‘why’ of it - understanding the connection which leads to changes in behaviour in the public space and to a higher quality of living and to its development and sustainability.

CITY PERFORMER leads to an ongoing understanding of sustainable city development, qualitative functionalities expressed by the needs and interests of the city’s inhabitants. At the same time, it opens up the arena for the connection and participation of the city creators and its citizens in modelling quality of life for the future based on information and portal access to open data. The CITY PERFORMER project is important for all major urban ecosystem interest groups, and for the city’s residents - as inhabitants or those also working in services, industry or as entrepreneurs; it also includes an informational and innovative knowledge platform for those in public administration (these outputs we call professional PLUG INs within the CP platform).

There are a number of applications that provide data, partial data or partial historical information, usually online or on demand. The question here is, if they open the way to more general knowledge.



CITY PERFORMER

Users

Residents - the broadest user base, a key stakeholder in the city, moderators of participatory activities with frequent active linking of living needs to the digital model

Professional groups that provide services in the urban ecosystem in conjunction with urban activities, developing a range of city functionalities (providing transportation, public or private services for regional housing, security, integrated information and knowledge for the decision-making process), ‘now’ requirements, history linked to prospects, business planning models

Public City Administration, a key planning and control authority for urban development.

Participation

CITY PERFORMER supports contributions of targeted participative data and information for the digital model of the urban ecosystem, allowing registered users to enter their environment. Contributions can be generated, for example, by sensing maps.

Business models

CITY PERFORMER in the form of a powerful data analyser and integrator - it perceives information and knowledge resources as outputs e.g. for the creative industry (architecture, software applications), for the technology industry (ICT and digitisation), for the construction industry (development and real estate) and for the financial sector (such as price maps) - these are the professional PLUG INs,

Digital twins

CITY PERFORMER enters the ‘digital twin’ field for both citizens and society. The reason why our digital twin focuses on the interaction of citizens and society is because today’s visible reality can be quite different from the nature of its problems and causes.

The digital twin is therefore a scientific tool which, however, progresses very pragmatically on the principle of collecting digital data, transforming them into the form of the questions ‘who, when, where, what’, followed with the integration of ‘how.’ The overall understanding of development and sustainability of the ecosystem is then carried on with the question ‘why.’

Smart and Modular Solutions for Municipalities

If we look abroad for inspiration for our smart cities, we should also ask about the problems and failures other cities have experienced. Knowing these issues and being able to avoid them is much more important for new projects than being familiar with success stories wreathed in laurels. First and foremost, municipalities must identify their own needs. As a rule of thumb, they should try to procure the best quality possible on a reasonable scale and for a good price.

SMATRIX Is the Ideal Tool for Long-Term Municipal Planning

Ing. Jaroslav Kacer, former Deputy Mayor of Brno City for Strategy, Smart Cities, ICT and e-governance

13 min

In recent years, “smart cities” has become a modern buzzword. Not even I have any idea who came up with the term, but, to be honest, I have never made the effort to try and find out. Nevertheless, I think that the use of this common term isn’t completely appropriate. In my opinion, the term should encompass all types of local government – not just cities, but also villages, associations of municipalities, provinces, states and, of course, the organisations that they establish or own. So, I would rather use the term “smart municipalities”, but I understand that the smart city buzzword is already ingrained in people’s minds. Moreover, the name isn’t really what matters. The two primary target groups for this topic are citizens, who are the users of municipal services, and the people “in power” – politicians, civil servants and municipal employees. This text is based on real-life experience with the implementation of the smart city concept in the second biggest city of the Czech Republic. However, it also utilises knowledge that can be gained abroad. I’d rather not be seen as some kind of preacher. My goal was to write an article which would primarily serve as a guide for people who want to carry out a smart city project or those who wish to form their own opinion on the matter.

What Does the Term “Smart Cities” Mean?

That is the question. Everyone has a different opinion, whether it’s people from local government, civil servants, academics or entrepreneurs. I feel that answering this question is a challenge, so first we need to have a good grasp of the topic. Municipalities should primarily use their common sense and see smart cities as a change in their approach with the aid of modern technology. For academic institutions, smart cities present a new area of study. This enables municipalities to utilise the outputs of academic work and also enables strategic cooperation in the testing and development of new solutions. The business sector is responsible for the execution, integration and provision of services through evolutionary business modules. This process involves the networking of various companies and solutions or the formation of inter-sectoral consortia.
General benefits of smart cities include:

- Optimisation and digitisation
- Efficiency and savings
- Comfort and convenient control
- Safety

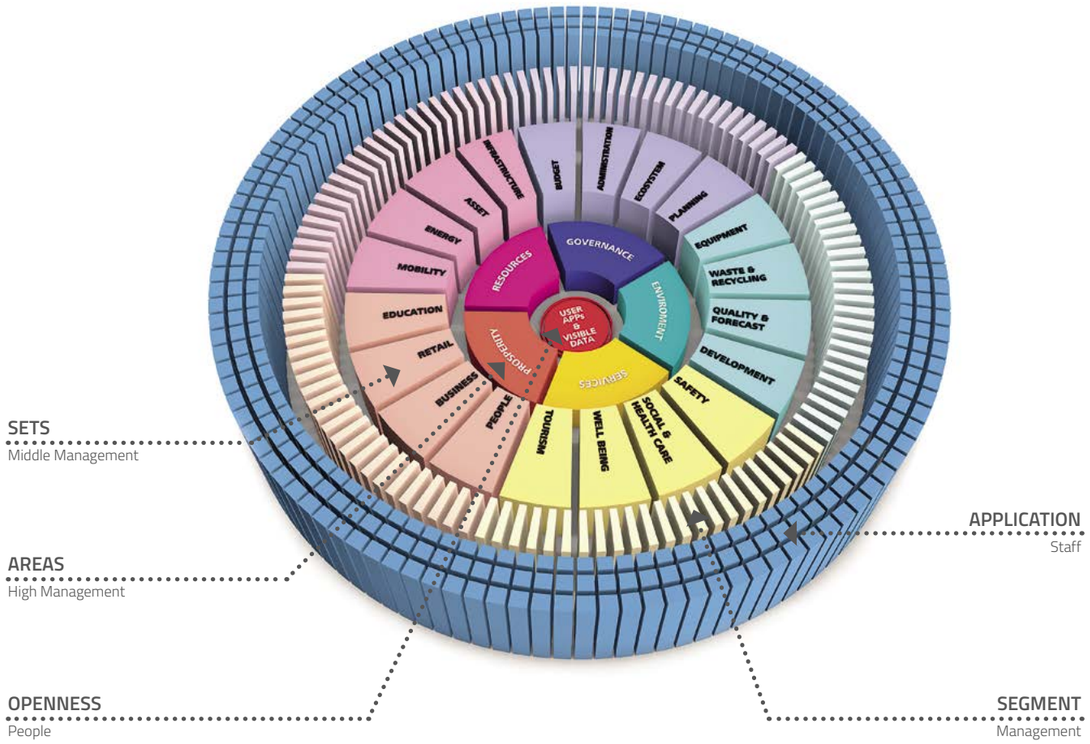
A smart park bench definitely won’t make your municipality any smarter. Everything should fit together like metaphorical building blocks that address various aspects of the municipality.

SMATRIX. Why Was It Created, Who Is It for And What Benefits Can It Bring?

In many areas, the dynamic and turbulent digital era of today makes it difficult to quickly familiarise yourself with the way things work. Before you know it, the ship has sailed. Municipalities are exceptionally vulnerable to this phenomenon, but, on the other hand, there is great potential in the area of smart cities. I already tried to explain my view of smart cities in the previous paragraphs. I think that municipalities can’t just buy new, “smarter” devices or invest in smart technology and expect that to solve everything. A smart park bench definitely won’t make your municipality any smarter. Everything should fit together like metaphorical building blocks that address, optimise and streamline various aspects of the municipality, keeping in mind their real-world sustainability.

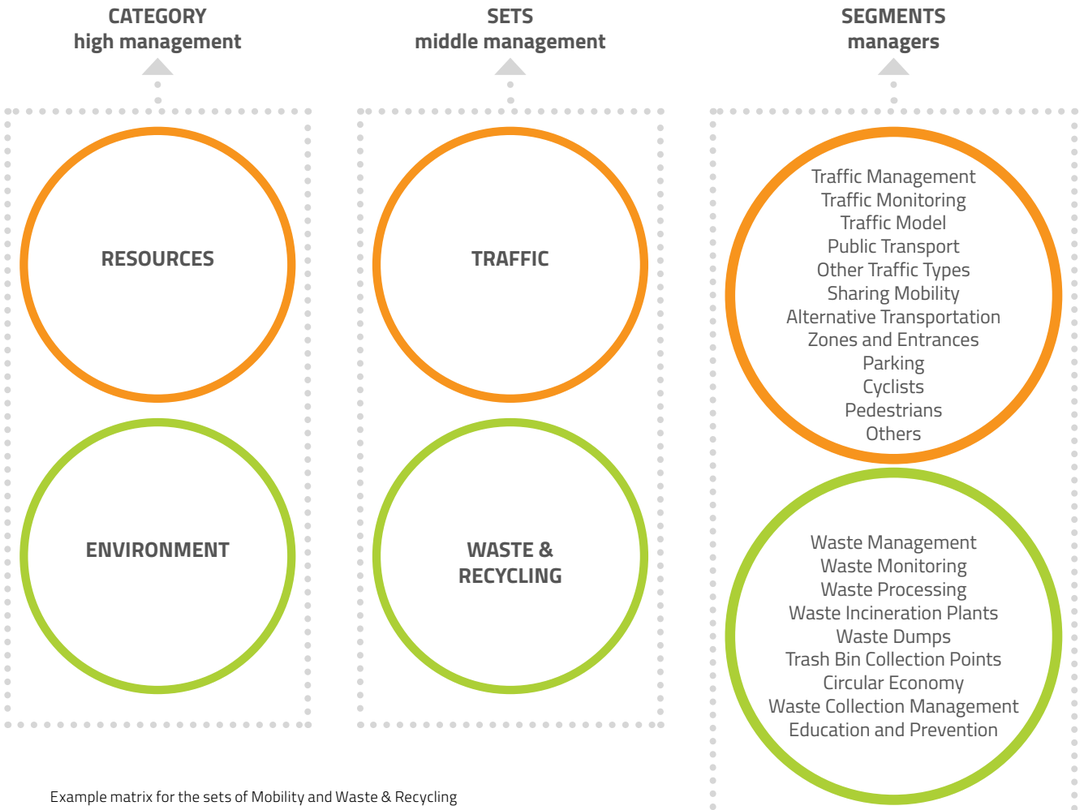
I decided to use my previous experience to create a basic framework of everything municipalities deal with, carry out and control. This gave rise to a unique, comprehensive ecosystem called SMATRIX. As the name itself implies, it’s a neologism formed by combining the words SMART and MATRIX and it refers to a smart framework, or matrix. My intention was to create a basic, but also comprehensive, user-friendly, logical and useful guide with clear rules. I wanted a model that would help municipalities and the organisations responsible to or owned by them to understand the smart city concept in all its complexity, not just its individual parts. This is something that other models fail to present. I created SMATRIX because I had not been able to find anything similar or equally useful. That is why I couldn’t simply take an existing model and make small improvements. I had to create this model from scratch.

SMATRIX



I approached it as an upside-down pyramid surrounded by data, followed by an integration platform and then applications. The apps can be utilised by several areas, sets or segments – to a certain degree, they can even be used by the general public. Then we get to the segments, which aren’t closed and can still expand. I follow a strict model: USER APPLICATION & VISIBLE DATA (citizens and municipal users) – AREAS (top management) – SETS (middle management) – SEGMENTS (managers) – APPLICATIONS (staff). The highest level in the SMATRIX ecosystem is AREAS, which consists of five basic groups. Each group then has a corresponding SETS layer, which is divided into four parts. This division into 20 basic sets gives municipalities the option to integrate both existing and new services and applications in individual parts of the ecosystem. Digitisation then enables them to be monitored.

The visual model of the SMATRIX ecosystem shows individual sets in different colours, which makes the whole system easy and intuitive to navigate. The image shows who the individual sets are meant for, making it possible to define the role of each person or institution involved, i.e. who can see what, who works with what and what they control, manage or oversee. The SMATRIX model uses the term “management”, which refers to the political representatives in charge, senior employees and organisations subordinate to or owned by the municipality. Of course, the size and activities of individual municipalities matter, which means that specific municipalities may choose to merge or simply ignore certain areas, sets or segments. This is not a recipe book that needs to be followed to the letter – it’s simply an illustration of the options municipalities have, so they can modify it to reflect their actual needs.



Example matrix for the sets of Mobility and Waste & Recycling

The primary goal of this division and these clusters of areas was to capture the fundamental idea what municipalities (Governance) work with (Resources) and what they influence (Environment, Services, Prosperity). The top of this "pyramid" is formed by open data and applications, which can be used by the general public. SMATRIX is just a general framework model. It is clear that some apps will be primarily used by management, while others will be more interesting for executive-level employees. So, how can SMATRIX be utilised further? As I already described in an earlier paragraph about approaches, it is ideal for long-term municipal planning (Strategy & Vision, Plan, Execution & Financing) and defining specific indicators and KPIs (Evaluation). I would like to use SMATRIX as a blueprint to evaluate the estimated benefits, cost and time demands of dealing with specific issues. For instance, the CitySys platform – an interdisciplinary solution for services organised in a functional open system – will already use this classification in its application. This gives politicians and other people in charge the option to easily check what their options are according to their defined roles and individual choices. One benefit of this solution is that is prevents the management from being bombarded with worthless data.

Who Should We Try to Get Involved?

It is crucial to get all stakeholders from the municipality and surrounding areas involved in order to form an ecosystem. You need to be open, keep people informed about various topics in advance and try to communicate as best as possible in order to prevent future problems and discrepancies. Various student competitions, hackathons or white papers can be used to present the ideas behind individual topics or to work on their solutions.

What Conditions Should Be Taken Into Account?

The most important condition will always be the size of the municipality. Naturally, big cities have different opportunities and conditions than smaller ones. For instance, the development, maintenance and improvement of integration platforms is still an untrodden path that will mainly be of interest to larger cities. I am only aware of Prague's intent to explore this area, so we'll have to wait and see. For everyone else, the ideal situation is having a professional solution which is modular, interdisciplinary (not just focusing on mobility, energy or some other isolated topic) and has an interesting business model that doesn't bankrupt the municipality in the long run. It is also necessary to define the ownership, use, export and updates of data, ideally including REST API. This will ensure that the system works as a whole even if there are changes in the future, for instance after a migration to new systems or applications. Individual municipalities must identify their own needs. As a rule of thumb, they should try to procure the best quality possible on a reasonable scale and with regard for future development. In other words, there's no need to use a sledgehammer to crack a nut.

When selecting individual solutions, you always need to consider whether they help fulfil the defined goals. Personally, I would base my selection of each solution on the following general principles:

- **MODULARITY** (freedom of choice, scalable as needed)
- **OPENNESS/INTER-OPERABILITY** (not completely closed, possible to interconnect)
- **EFFICIENCY** (savings, optimisation and simplification, increased convenience)
- **SMARTNESS** (constant improvement, following current trends, innovations)
- **RESPONSIBILITY** (addresses global goals, improves the state of the municipality for future generations)

In general, the worst possible approach would be to simply see smart cities as an opportunity to buy high-tech devices just because you can afford them and perhaps they might also solve your problem. If this happens, reality can hit hard. For instance, there is a city which has opened a new traffic monitoring centre. Although it looks good on paper, its functionality is worse. Every issue is addressed using a different app and there is absolutely no inter-operation.

Financing

There are various possible ways of financing. One that has been largely ignored until now is so-called pre-commercial public procurement, which, of course, has its own specific conditions, but is especially suitable for smart cities. Then there is the option of using models based on EPC (energy performance contracting) or operational leasing and loans (these can be interest-free if national or European banks choose to prepare a programme to support this type of financing, for instance in order to reduce energy consumption). If we look for examples from Austria, we can see that the city of Vienna uses bonds. The municipality itself does not have to be the primary investor. It can also use crowdfunding projects, provided that they clearly define what is being financed, how much it will cost and what benefits it will bring, including a minimum funding goal that needs to be met in order for the project to be carried out. Another option is using a PPP (public private partnership) model. Finally, projects can be financed using own resources, grants and national or European subsidies. However, if subsidies are used, I would carefully consider the scale of the project to avoid future problems with its sustainability after the funding period ends.

Experience, Inspiration and Benchmarks

We need to exchange experience across Europe and the world, ideally starting with our failures and then moving on to examples of best practice. After all, in life we learn from our mistakes. In my opinion, it is important for municipalities to share information about things to avoid, things to do differently, etc. Drawing inspiration from other municipalities is good, but then it also needs to be adapted to your specific needs. What sets this approach apart from mindless copying of solutions is the learning process – what works in one place may not work elsewhere. In my former position as Deputy Mayor, I tried to promote the idea of so-called observation visits across the European Union. Their primary goal would be face-to-face exchanges of experience between the responsible politicians and officials. Sometimes it can be helpful if you read an article or paper, but personal experience and a hands-on approach is irreplaceable. We made use of this opportunity several times, and even the most obstinate officials, originally convinced that something was impossible, changed their mind and became advocates of change. I personally feel that it's good or even desirable for municipalities to compare themselves with others all over Europe and the world. It allows us to regularly evaluate this benchmark to see what we have achieved over time and then look for causes of the change or stagnation we are experiencing.

The Future

Depending on what we deem appropriate, we will be using a wide array of apps without even knowing it. Many processes will become fully automated and implement the use of artificial intelligence. As a personal example, I will only go to government offices if I really want to, because I will always have the option to do everything electronically. However, one key issue remains unsolved: where should we draw the line to protect our privacy and personal freedom in order to prevent a Big Brother scenario from happening? Bypassing the personal decisions of citizens and monitoring them without their knowledge definitely isn't an option. I'll leave the final answer to you, but keep in mind that China is already testing its social rating system which evaluates all available resources and consults the corresponding directive to determine what behaviour is "desirable" and what isn't.

The Will to Be Smart

Local Governments Have What They Need to Make Cities Smart

Marcela Heglasová, RECO

15 min

“We need to prevent the Smart City movement in our municipalities from turning into a clearance sale of technological solutions. This would devalue a truly excellent idea and reduce it to the level of eGovernment – a concept that has been problematic for a long time now, making people rightly suspicious. Of course, we will need to be patient because we cannot do everything at once. We will also need to work with honesty so that we can distinguish between that which is beneficial and that which is purely attractive. Another must is continuity so that our priorities do not change every election period,” says MICHAL KALIŇÁK, spokesperson and secretary of the expert committee at the Association of Slovak Towns and Villages.

When was the first time you came across the Smart City concept and what impression did it leave?
The first time the concept of "smart" used in the context of local governments put a smile on my face was around ten years ago. When I first read about its basic principles, I felt that it was simply modernisation described using modern lingo. This is why I had a reserved attitude at first – I was still trying to find its added value. I mean, we can't just come up with a new term and pretend that the concept it describes is exactly what we need. But it was my search for added value that ultimately convinced me that the Smart City concept is worth it. Now that we can compare them with Smart Cities, the partial solutions and pilot projects that we have experimented with suddenly appear risky, as if we were playing games with people's hope. In their essence, Smart Cities are systematic, continuous and always open to new impulses.

Why do we need to be "smart" about the way we live? Some people might think that our lives aren't so bad if we compare them with the lives of people from other countries...
Smart Cities are a foundation for many public policies. If I had to describe the concept using simple language, I would say that it provides us with guidelines and solutions for various life situations that we encounter as people and citizens. This is why we need to realise that the concept is not merely about technology. The Smart City philosophy is based on common sense. Whether our lives are good or not is a matter of personal preference, desires and reality, but the truth is that our lives can always improve. However, we can't just wait for success to come to us – we need to work towards it. We have tried-and-tested solutions at our disposal, as well as others, which are still gaining ground. They're already available – all we need to do is take them, implement them in our context and then analyse the difference they make.

Will we copy existing solutions or just look for inspiration?
Copying complete solutions is a good way of minimising the risks associated with pilot projects. These projects aren't cheap, they require people with a lot of enthusiasm and they do not necessarily achieve the goals they set at the beginning. This is why copying makes sense. However, our laws are different from other countries in many aspects, so even inspirations themselves can only succeed here if we adapt the solutions to our context. In any case, real-world examples show that local governments should not simply be viewed as something that only lasts a single election period and does not exist outside the local area – they suggest that we should try to look further than that. Every tried-and-tested solution from another country is a story – and we need to know about the good ones.

There are contrasting opinions about the adoption of best practices. The counter-arguments aren't necessarily related to differences in legislation, but they also point out that various countries have different social, cultural and economic starting points.
Naturally, indiscriminate consumption of everything that works elsewhere cannot be turned into our strong suit. Adopting solutions without adaptation, for the mere reason that they have been implemented abroad, can cause problems. Of course, we do need to acknowledge the position of Scandinavian countries as European leaders in the implementation of Smart City principles. From a historical and social perspective, their position is very different from ours. In our context, we should primarily focus on the neighbouring V4 countries, which implemented the concept of local government in 1990, just like we did. We have undergone important economic, political and social transformations together, yet independently. We are also all united under one roof, whether it be provided by the EU, OECD or NATO. There are only small cultural differences and language barriers between our countries, yet we can see that our neighbours are already one step ahead of us. Here, I would like to return to the original point that we can't just implement everything that works abroad, but that we should rather search for inspiration, look at things differently and focus on our starting point instead of our problems. Our geographic proximity and our equal desire to develop are the drivers of change. Of course, we are all human. This means that another aspect that comes into play is our natural envy, in the positive sense of the word, the type of envy that makes us grumble: "If it works in the neighbouring countries, why wouldn't it work in Slovakia?" The very fact that we can and want to compare ourselves is positive because it allows us to objectively evaluate our situation and propose solutions.

Our geographic proximity and our equal desire to develop are the drivers of change. This means that another aspect that comes into play is our natural envy.

It probably makes complete sense that local governments will be (unless they already are) the primary entities responsible for the promotion and activation of Smart City concepts. How ready do you think they are?
Last summer, the Association of Slovak Towns and Villages conducted a survey that focused on this agenda and we analysed the results in a previous issue of our magazine. The numbers clearly showed what our mayors think about smart policies. They view Smart Cities as a tool that can be used to modernise local governments. The implementation of the Smart City concept cannot take place without the involvement of the local government. After all, it is the local government that has direct everyday contact with people. If we take into account, the fact that more than 90% of all public-benefit activities are organized by cities, towns and villages, either directly or through municipal enterprises, we get a clearer picture of the wide scale of areas and services where municipalities can make full use of innovative approaches. This applies to street lighting, waste management, parking policies, road management and maintenance, public spaces, snow removal, sporting facility management, cultural organizations, schools, social care establishments, public transport and many other areas. From the perspective of economics, public services, attractive public spaces and future growth, the Smart City concept can be used as a foundation for solutions in 4,300 different areas. These are the things that significantly influence people's local pride and encourage them to participate actively in local affairs.

What measures are there to educate members of local governments?
There is an ongoing national project entitled Modernising Local Governments, which is supported by the Efficient Public Administration operational programme. This project includes regular events that we organise in the Slovak regions, presenting smart solutions used by local governments in all the V4 countries. Solutions that have been successful in neighbouring countries are perhaps the best way to introduce the core Smart City concept to members of our local governments. In addition to these events, we also organize an annual conference entitled Municipal V4, which has a strong focus on the topic of Smart Cities.

The interest of people in participating in these activities proves that they are worth organizing and that our local governments are interested in information that can help them increase the happiness of their inhabitants, who need to be seen as the end users of the benefits that local governments provide.

How ready are we for Smart City projects from an infrastructural perspective? Do we have everything we need for our cities, towns, villages and regions to become smart?
Surveys and discussions with members of local governments suggest that we already have the most important thing, determination. From the perspective of infrastructure, the situation isn't ideal yet, but depends on whether we focus on villages, towns, cities or the ever-growing satellite towns. What we need most is a single authority that would administer smart policies, help remove barriers, openly talk about the potential risks and guarantee that the Smart City philosophy remains intact, thus preventing the whole Smart City movement from turning into a clearance sale of technological solutions. If the last thing I mentioned happened, it would devalue a truly excellent idea and reduce it to the level of eGovernment – a concept that has been problematic for a long time now, making people rightly suspicious. Of course, we will need to be patient because we cannot do everything at once. We will also need to work with honesty so that we can distinguish between that which is beneficial and that which is purely attractive. Another must is continuity so that our priorities do not change every election period. Only if we are able to address all of these three needs do we have a chance at succeeding together. We need to listen to people, keep up with development and base our predictions on data rather than subjective feelings. Many of these things depend on us; we are the ones who will shape the future. We also need to openly discuss how smart solutions should be financed and how public policies should be adapted to accommodate them.

Financing is certainly one of the questions that get asked most frequently. So, who and how will pay for all of this? Are there any specific financing scenarios or models prepared?
First and foremost, financing smart solutions should be seen as an investment that needs to pass the test of time. This means that these solutions are meant to reduce the original costs, increase the quality or cost of public services or enable the use of new data. As a result, the initial inputs cannot be viewed as useless expenditure, but rather as meaningful investment. Of course, we also need to look around to determine whether it's more efficient to apply for an EU-funded project, a cheap loan or a PPP project. The more financing alternatives local governments can choose from, the easier it is for them to find the most efficient method of financing.

You mentioned the need to establish some kind of overarching authority. Who should it be, what powers should they have and who should they be nominated by?
I can imagine Slovakia forming its own Ministry of Regional Development, which is a model that has been successful in both the Czech Republic and Poland. In Slovakia, this agenda is divided between several ministries. Moving it all under one roof and strengthening the ministry's powers in the area of smart policies would bring tangible benefits. Of course, this would require close cooperation with the ministries of the economy and the interior, representatives of local governments and the private sector. I think that this can be the solution. Although it requires political will, with less than a year left until the elections, it is probably best to go in this direction and put pressure on political representatives so that the elections bring about the political will to turn smart policies from a "hobby" to a highly professional matter.

What priority will shape the Slovak city of the future most? Is it ecology, safety, mobility, support for community life or something completely different?
Cities, towns and villages develop under the pressure of their own possibilities and the desires of their inhabitants. It appears that there is a healthy sense of rivalry between local governments. They are starting to make comparisons between each other and their inhabitants are comparing the services provided by "their" local government with those provided by "others". This is a driver of necessary change. As a result, the shape of local governments of the future also depends on how actively they will engage in dialogue with people, the private sector and other parties relevant in local development. The inhabitants, who are the end users of all the provided benefits, need a healthy environment, but also support for economic mobility, quality public services and they also need to feel a general will to help. Ranking priorities is difficult because it is up to each local government to do so. Some of them might feel the need to start implementing smart solutions in the areas of transport and ecology, others in the areas of safety or architecture and then there are some that would rather focus on energy. This diversity of needs is a natural reflection of the differences between local governments. This prevents us from creating a universal list of priorities. What needs to be done instead is to divide each area into smaller parts and describe the necessary steps for each of those. Only then can local governments focus on solutions. After all, an attractive aspect of smart solutions is the ease of interconnecting them with one another.

Does Slovakia already have successful examples of early smart solutions on a municipal or regional level?
This might come as a surprise to you, but we do. They can even be found in places where few would expect them. In the Kysuce region, a regional telecommunications provider has built an optical network that connects more than 20 municipalities,

We must prevent the whole Smart City movement from turning into a clearance sale of technological solutions. It would devalue it to the level of eGovernment – a concept that has been problematic for a long time now, making people rightly suspicious.

providing a broad selection of TV programmes, internet connection and local TV stations. Moreover, they are currently considering launching a CCTV system together. Personally, I am very happy that more examples like this are popping up. Several municipalities have managed to join forces and cooperate with the private sector. It's a great idea that can show other local governments the way. We have examples of municipalities that have joined forces to create a common waste management system. They have their own enterprise and influence over prices, they set up their own system to motivate people to sort waste and they are also active in the private sector. But what is equally important, they realize that working with data and technology increases efficiency. So that's another specific example that proves that smart solutions work.

Could we say that Smart City concepts have become a topic of public discussion? Have citizens shown interest in joining the dialogue?

Discussions are necessary if we want to adopt the Smart City philosophy and spark enthusiasm among local governments, showing them that smart policies can be the answer to their inevitable need for modernisation. So far, I feel that the discussion has focused exclusively on local governments, a few governmental departments that have a certain amount of influence in this area, enthusiasts and companies. It would definitely be good if the dialogue reached the general public, but our main hope is that people will start to look for information themselves. It is important to take small measures to show people that the solutions that are being prepared will make their lives easier, improve communication, expand public services and have a generally beneficial effect on their everyday lives.

Cities of the future will make use of advanced sensors, CCTV systems and the collection, storage and analysis of data, part of which will be private in nature. I assume it is clear that the decision to live in a smart city will also mean that people voluntarily surrender part of their personal freedom. What will we get in return?

People often wonder if they pay taxes in exchange for services or if it is just a form of punishment. And these views do have a point. Why should you pay for terrible services? That's why we shouldn't offer people something in return, but rather offer added value. I've already mentioned parking policies that would solve drivers' needs using camera systems and parking navigation. If we look at many other life situations, we will realize that people need many of the solutions Smart Cities offer, but they aren't able to specify their needs because they aren't familiar with smart policies. This is natural – it's not a weak point of smart policies. What could be a weak point is when local governments fail to sufficiently react to the justified needs of their inhabitants.

Countries in East Asia have implemented some solutions that feel almost dystopian. The Chinese social scoring system works as a real-world Big Brother while Singapore aims to monitor how often people flush the toilets in their homes. Where should we draw the line? After 40 years of administration orders and surveillance, an entire generation of Slovaks are much much warier of their privacy.

Everything is a matter of scale, which is also true for public policies and smart solutions. It is up to us to decide how well we are able to communicate the message that CCTV is about protection, not intimidation. Smart waste management is also about what we can do today for future generations. Just like no law defines what "good" is, there are no inherent limits for smart solutions. The limits are only defined by your possibilities and capabilities. In Slovakia, we still have a relatively long journey ahead of us before we can state that smart solutions are a normal part of our lives. Perhaps this is an advantage because it gives us time while others test and abandon extreme solutions. I see these as experiments to find out what technology can do and what people are still willing to accept as beneficial.

Mgr. Michal Kaliňák, PhD.

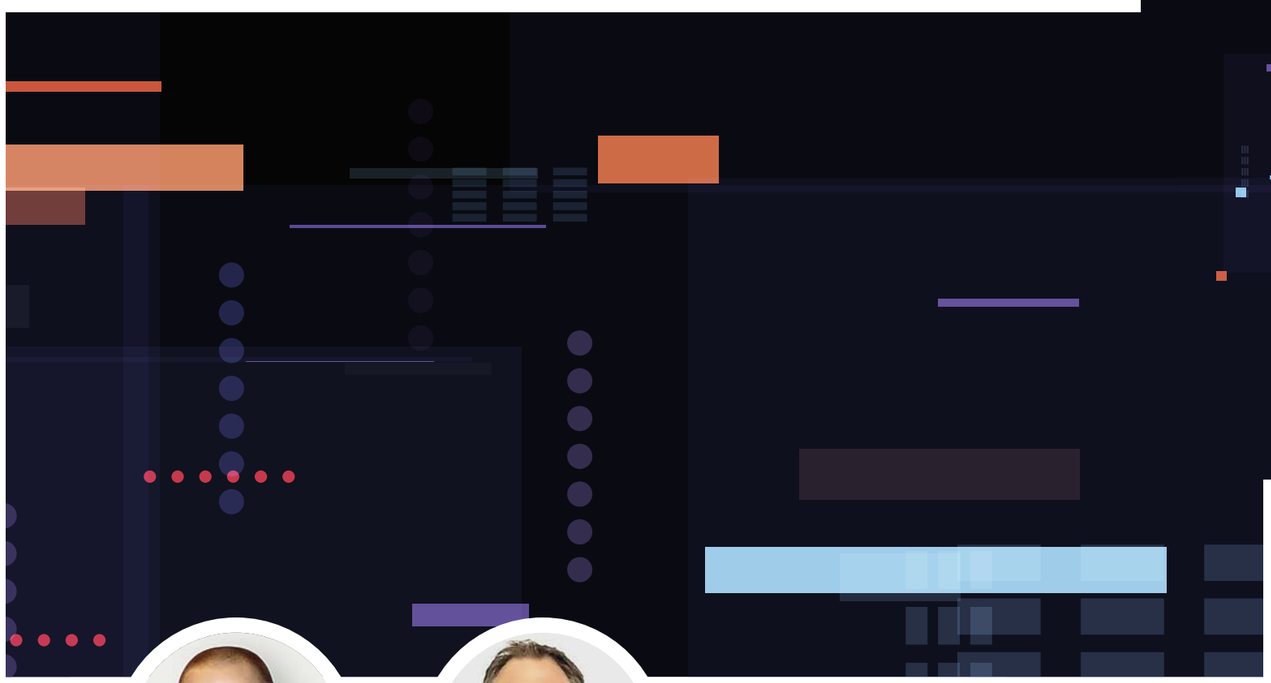
Michal Kaliňák graduated from the Faculty of Arts at Prešov University with a degree in political science and Ukrainian language and literature. In 2011, he earned his PhD. after studying political theory at the same faculty.

He worked in state administration as an assistant of the Speaker of Parliament; an advisor and spokesperson for the Deputy Prime Minister for the Knowledge-based Society, European Affairs, Human Rights and Minorities; the head of the press department and the minister's spokesperson at the Ministry of Education, Science, Research and Sport; an advisor for the State Secretary at the Ministry of Finance; and the director of the Youth Support Department at the State Institute for Vocational Education.

He gained experience with local government as a city council member, press secretary and PR manager. His current position is as the spokesperson and secretary of the expert committee at the Association of Slovak Towns and Villages. He is also a member of the editorial board of Komunálny spravodajca – a specialized magazine with a focus on public administration.

The End of Traffic Collapses

The Infrastructure Is Not Keeping Up with the Increasing Number of Cars



Milan Veterník, CitySys

Misha Van Poppel, ARS T&TT

7 min

Times of cars being exclusively for the rich are long past. In the last ten years, the rise of the economy and the population's purchasing power has brought an over 60% increase in the number of passenger cars on the roads of Slovakia. If we add freight transport and the low quality and density of roads, we get a good insight into why traffic regularly collapses during business days in most Slovak towns and municipalities. ATMS – Advanced Traffic Management System – can be a solution to this problem.

As a result of the increase in the number of passenger cars and the freight transport density, we are increasingly witnessing or directly involved in the paralysis of urban life caused by traffic congestion. Let's not kid ourselves - the demands on mobility, services, and transportation will only continue to grow. So, when we talk about the development of transport, we mean taking measures that will enable it to be built at a sustainable level. The basic characteristics of sustainable transport include: accessibility, profitability, safety, attractiveness and environmental friendliness. It is difficult to meet all these demands with limited financial resources. However, there is a solution. It is IT integrated into smart traffic management systems.

The Value of Traffic Management

The main task of transport is to create favourable conditions for frictionless transfer from point A to point B. If the flow is disturbed for any reason, transport fails to fulfil its main function. The time spent in jams or forced detours is often a quantifiable item. On the other hand, transport infrastructure is not a medium that can be inflated overnight to the desired size. We have to assume that infrastructure is more or less a given, and so look for new ways to ensure traffic flow in the shortest possible time. Here's where smart management comes into picture. Smart traffic management systems can receive, evaluate and process data into useful information in real time and provide it to road network users. Such information may be, for example, a report on the current traffic density in a selected area or traffic density forecast for a selected time. By managing the traffic and providing useful information we can ensure

Congestions paralyse our cities. Let's not kid ourselves – the demands on mobility, services, and transportation will only continue to grow. Building transport infrastructure with limited financial resources would be challenging. However, there is a solution.

efficient operation of intersections, roads, or highways, actively prevent traffic congestion, reduce the negative impact of traffic accidents and, at the same time, contribute to increased traffic safety.

The traffic management system helps traffic management staff to perform well-functioning traffic and road systems management. It collects real-time data from all the existing road systems and presents them in the user interface in different views. This information can be used in the system for various traffic management activities, for example for sending relevant route information to electronic panels, alerting drivers on various topics such as traffic jams and other unusual events, analysing the activities of the traffic light signalling systems at intersections and their dynamic management, or analysing the activities of the security systems at railroad crossings.

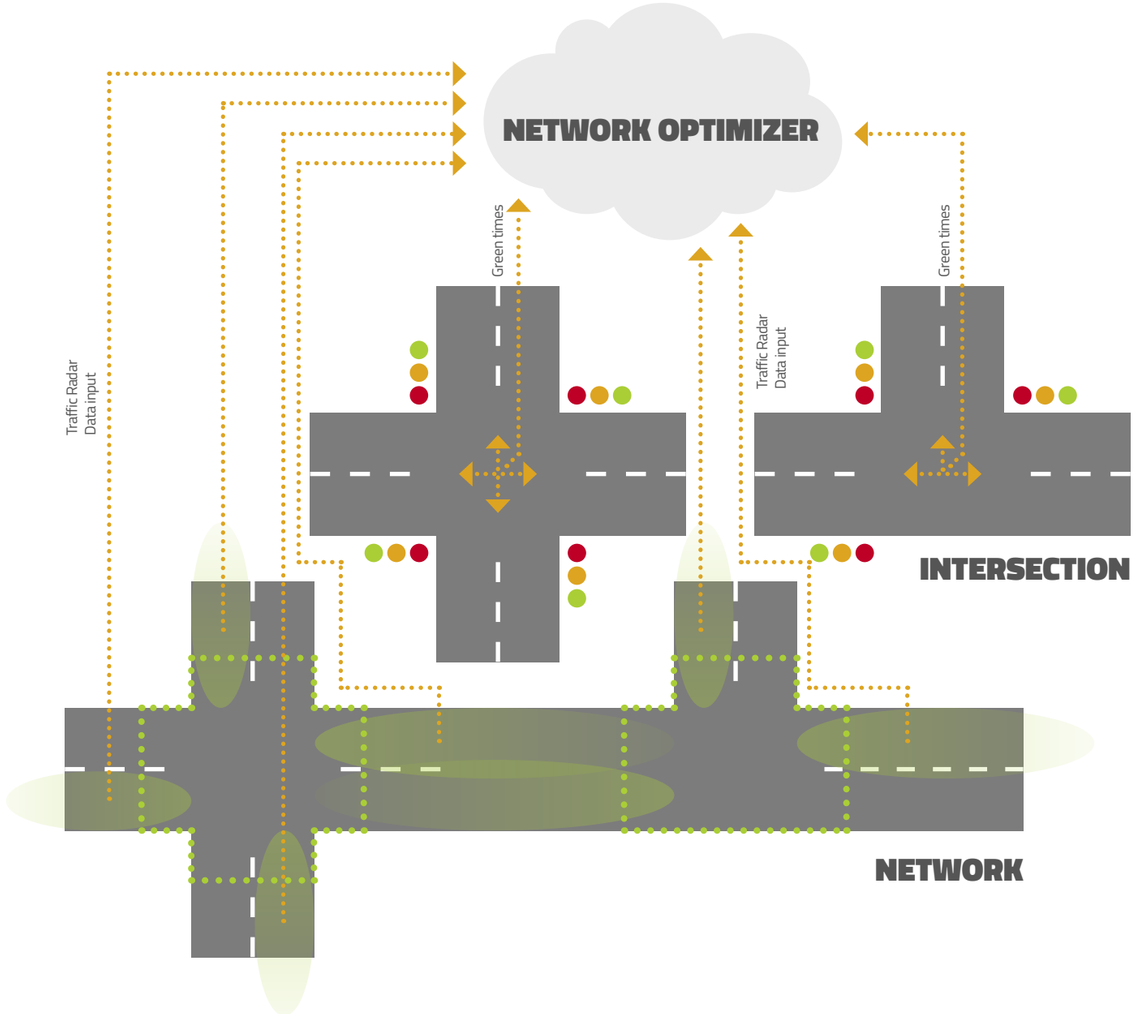
The aim of the traffic management system is to use information about the current traffic situation from various types of sensors (induction loops, traffic radars, cameras, etc.), or other available sources (floating car data, GPS navigation, SIM cards) in order to:

- reduce traffic congestion by redirecting traffic flow to alternative routes
- reduce transport emissions by maintaining a steady flow of traffic
- reduce fuel consumption and negative environmental impacts

Advanced Traffic Management System (ATMS)

ATMS is a road traffic management solution to address the increasing overload of urban roads. The main objective of public authorities in relation to the increase in individual car traffic on urban roads is to combat congestion. Budgetary constraints on expanding existing infrastructure are constantly increasing the need to focus on cost-effective smart traffic management solutions. In ATMS, ARS traffic radars, which are integrated into existing traffic controllers for light signalling devices, are an innovative source of traffic data, allowing for advanced coordination of intersection networks. This coordination is achieved by cooperation of the Intersection Master and the Network Master which tackles the overload of individual urban communications across the road network in a comprehensive manner.

As a result, the overall traffic situation in the city is improved and the road users' driving time is reduced.
ATMS is an efficient and cost-effective way to ensure that the full capacity of the road network is used as much as possible and to improve traffic flow with very limited structural or organisational impact. The enhanced user interface of ATMS provides a real-time overview of traffic situations and allows for interaction with the transport algorithm. In the case of traffic measures such as green waves or preference for priority vehicles, the event and incident scenario can be configured and implemented by „pressing one button" by authorized users.
Another advantage of ATMS is that it can be integrated into an existing city dispatch centre or available in the cloud, and can even be provided as a service that is fully managed by an external traffic control centre.



ATMS Use Cases

The traffic management solutions developed by ARS T&TT have proven their worth during several projects including:

o PPA-Noord: the pilot Amsterdam Project had the intention to verify the use of queues at traffic lights detected with radar and loops to identify if they can optimize buffer space use with the goal to prevent gridlocks for commuters traveling between Zaandam and Amsterdam.

o AFM Rotterdam: this project aims to deploy an entirely autonomous system that would maintain the flow of traffic, road safety and air quality around the Maastunnel. The traffic management solution of AFM relays on traffic radars measurements to estimate queue lengths and ultimately influence the traffic control at the intersections surrounding the tunnel.

o Challenge Flanders: the regional government of Flanders has been looking to test new innovative traffic management solutions for intersections. They to implement ATMS; it is at the moment an ongoing project and it will be the first implementation of the full ATMS end-to-end solution.

Richer Data at a Lower Price

Accurate real-time traffic monitoring is a key input to any traffic management system. ARS traffic radars are an ideal tool for advanced data collection and represent the first generation of a smart unit “at the roadside”. Their contactless vehicle detection allows non-invasive installation using existing infrastructure (e.g. public lighting poles), resulting in several economic and environmental benefits. Their ability to track vehicles individually over a long section of road allows the system to provide a much wider range of traffic information. This innovation opens the door to a whole variety of new smart traffic management solutions, from current traffic light management systems to future V2I communications.

The Latest Algorithm

With ATMS, light signalling devices are controlled by cooperation between a local traffic light module and an entire network control module that correlates multiple intersection traffic information. The overload cannot be solved by increasing the throughput of individual intersections but by taking into account the traffic flow of the entire transport infrastructure network.

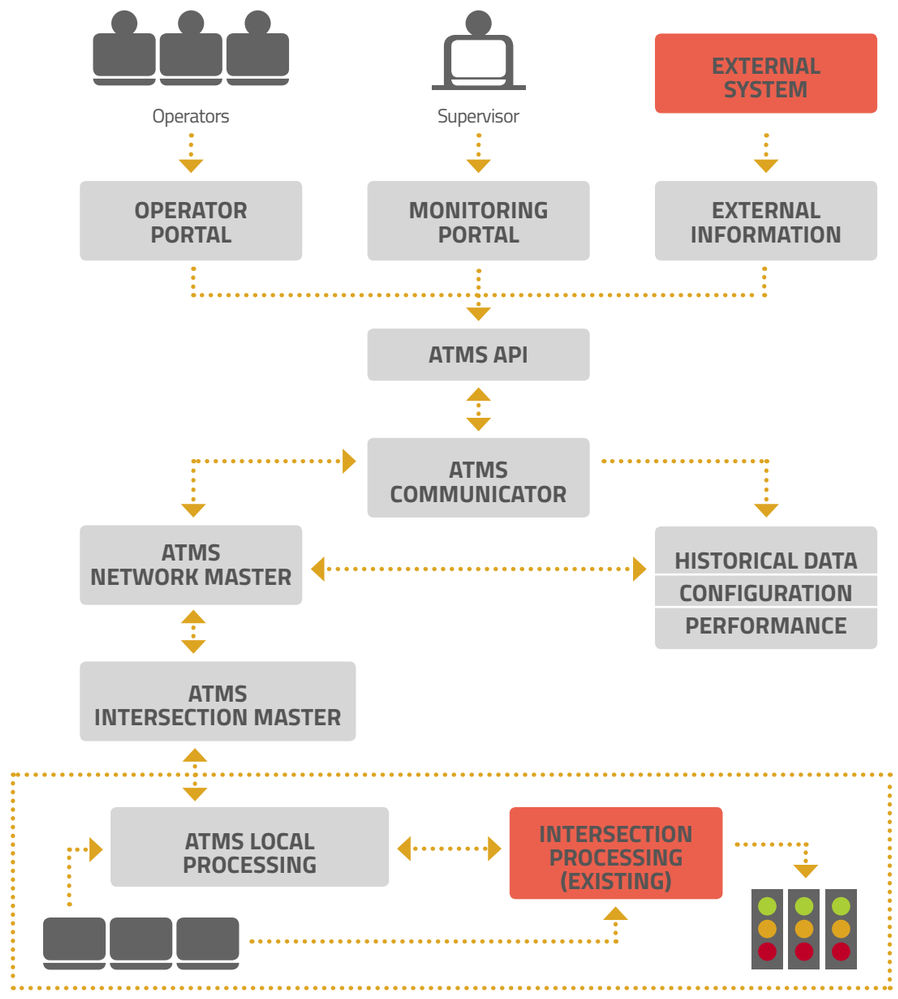
An adaptive control system that uses the vehicle position acquired from radar data ensures that vehicles entering the intersection may cross it as soon as possible. At the same time, the system evaluates the formation of traffic jams throughout the network and automatically adjusts the length of the green lights at traffic lights to eliminate traffic jams that ultimately paralyse the entire city.

ATMS Architecture

The ATMS Local Processing Module is linked to an existing Road Traffic Controller to obtain information about the current situation at the intersection and to send optimised times for the green light. Intersections are controlled by the Intersection Master module. This module contains advanced ATMS algorithms that take various aspects into account. One example is the extended radar estimate of jams or the use of historical data. At a higher level, in the ATMS Network Master, network management is implemented to optimise interconnected intersections. Based on different requirements, it is possible to configure green waves and/or preferred routes on different parts of the road network. The system provides configuration and monitoring portals that enable operators and supervisors to control the network. Additionally, the performance of algorithms in the system is continuously evaluated. This information is used in both direct feedback and other improvements.

The End of Traffic Collapses

Ensuring smooth city traffic is one of the most common demands that citizens address to their municipalities. It is only natural that many elected representatives feel that they face an insoluble problem, which by its nature often extends beyond their competences. However, the experience of implementing smart traffic management systems in cities clearly demonstrates that there is an efficient and cost-effective solution that can be taken into account and used by each and every municipality in the Smart City transformation.



Smart Pedestrian Crossing

Standard Lighting of Pedestrian Crossings Does Not Utilise Its Full Potential

Tomáš Hutta, CitySys

6 min

By implementing IoT elements and interoperability principles into pedestrian crossing lighting, we can increase safety and create a 360° monitoring point and an effective tool to increase the discipline of all road users, without the need to build additional infrastructure.

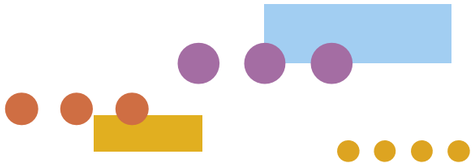
Pedestrian crossings are usually marked by horizontal white stripes on the road surface to signal to pedestrians where they can cross the road. They are usually placed before the intersection, on communications with high traffic density and near points of interest, such as authorities, schools and shopping centres, where more people are expected to walk. The available statistics show that pedestrian crossings are also places with high traffic accident rates.

Traffic situation analyses and the results of monitoring the development of accidents suggest that the most common causes of accidents at pedestrian crossings are the unexpected entry into the driving route of an oncoming motor vehicle and an incorrect estimation of when to cross the road. The results also show that women show more aggressive and erratic behaviour at pedestrian crossings. New technological solutions using IoT and interoperability are one of the simplest and, at the same time, the most comprehensive ways to increase the safety of all road users, streamline the taking of evidence and enforcement of fines for traffic offences and bring many other benefits. And they can be integrated into an existing public lighting system.

Standards Do Not Solve the Problem

Standards that apply to pedestrian crossing lighting precisely define how the crossing is to be illuminated, where the lamp is to be placed, where the luminous flux from the lamp should be directed as well as the level of illumination of the road surface. I see two problems here. The first problem is that the standards only deal with the lighting of pedestrian crossings at night, but don't contribute to safety during the day. The second problem is that even if the lighting suppliers meet all of the requirements, they cannot influence the behaviour or alertness of road users. Research conducted on the behaviour of pedestrians has clearly demonstrated that their ability to concentrate when crossing the road is now considerably weakened, since much of their attention is consumed by their smartphones.

This development is addressed by new smart solutions that involve placing lighting elements directly on the road surface into the horizontal field of vision, where the attention of the modern pedestrian is concentrated. These smart solutions come in the form of special surfaces with LED backlight, for example, to complement the traffic light function on the road. In IoT solutions, such a function can be triggered by a sensor that responds to a pedestrian approaching the road. The same sensor can also trigger signalling and warning elements on the approaching driver's level and warn them about the proximity of a pedestrian crossing or a cyclist close to their vehicle.



Imagine what we can get by installing a 360° camera, sensors or intercom on a public lighting pole near a pedestrian crossing and connect it with a parking management system.

Day Guarding of Public Lighting

Already in the previous article, I wrote that public lighting as we know it is ceasing to exist. Of course, its night guard will be preserved. It may even be more useful and more economical than ever before, provided that we integrate IoT technology into the existing standard lighting or directly use IoT lighting. Sensors aggregated into smart lamps will then be able to operatively adjust the light levels at the pedestrian crossing and in its proximity to current weather conditions, traffic density, astronomical time or simply according to whether pedestrian movement is detected near the crossing or in its immediate surroundings.

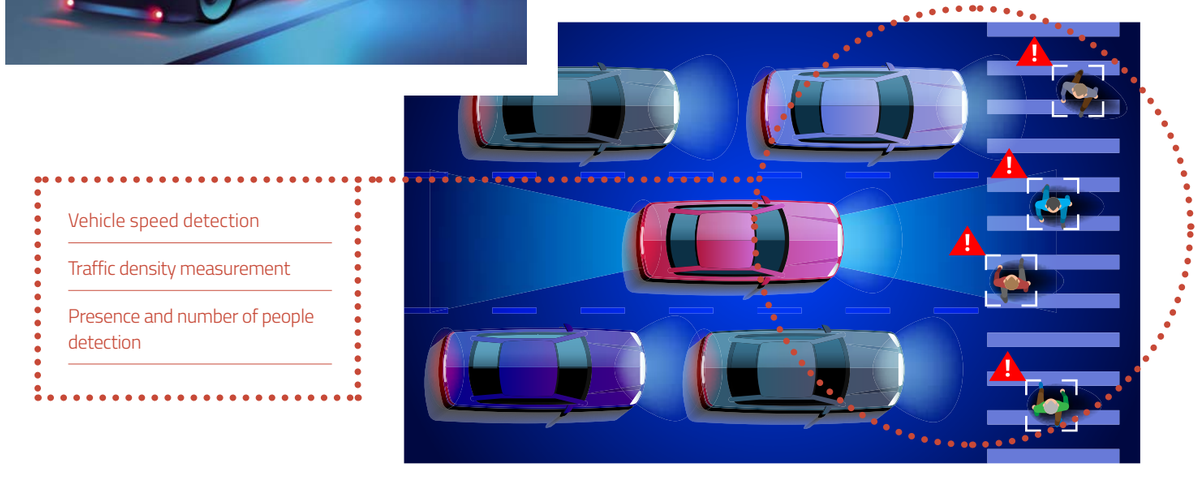
Equally important, however, will be the operation of the public lighting network during the day, when other additional IoT devices capable of communicating with each other will benefit from the lighting's connection to the electricity network. Imagine what we can get by installing a 360° camera on a public lighting pole near a pedestrian crossing. We will not only get a 24/7 record of the events at the crossing and in its proximity. By connecting the camera to other sensors, we can also respond to the situation at the crossing in real time. This means that it can act as a full-featured sensor, trigger signalling or adjust the traffic light switching interval. In addition, we can also collect, analyse and process data that will enable us to optimise the traffic situation in the long term.

A lighting pole near the pedestrian crossing, equipped with a camera and other sensors, becomes a multifunctional monitoring point that measures the traffic density, the speed of vehicles, the number of people on the street and the number of people using the crossing. It will also be able to monitor the number of free parking spaces near the monitored area and send relevant information to the smart city parking system in real time. At the same time, it can scan the immediate surroundings of the crossing and provide security authorities with evidence in the event of a forbidden stop or accident. Its security potential can be further increased by integrating an intercom device designed for two-way communication with security forces in case of an accident or crime. Therefore, in a single lighting pole we can aggregate a number of useful functions benefiting individual road users as well as the self-government.

The Most Vulnerable Places

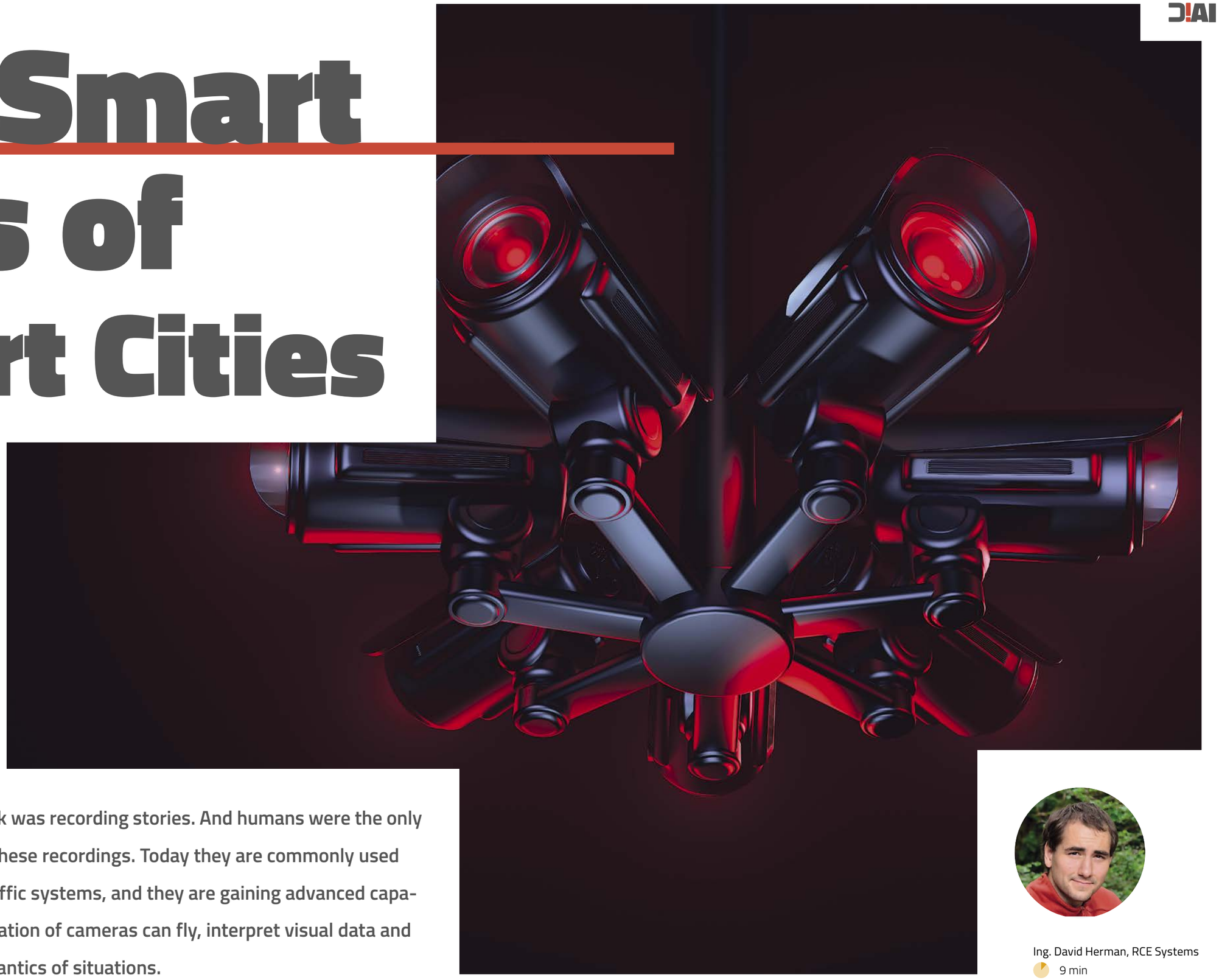
Pedestrian crossings are the most vulnerable places in every city and municipality. A smart pedestrian crossing is one of the ways to, first and foremost, make road traffic safer for all participants. At the same time, such a smart crossing becomes a full point of central data collection that can be further processed and analysed in a smart city platform for the comprehensive management of the smart city. In addition to improving safety, a smart pedestrian crossing can participate in the overall monitoring of the traffic situation in the given area and provide data inputs to optimise it.

This makes us believe even stronger that, if we only use standard lighting solutions, vertical or horizontal, we will not make use of the full potential that modern public lighting already offers, i.e. to be a fully-fledged part of a comprehensive smart city solution with everything it includes: connectivity, ecological and economical operation, possibility of control based on the current weather conditions, traffic situation or unforeseen situations. It also goes without saying that the recipients and end-users of the resulting benefits will be enjoyed by the residents of the smart city themselves.



The Smart Eyes of Smart Cities

Cameras with Artificial Intelligence Improve Security, Parking and Traffic Flow



In the past, their main task was recording stories. And humans were the only ones able to understand these recordings. Today they are commonly used as part of security and traffic systems, and they are gaining advanced capabilities. The newest generation of cameras can fly, interpret visual data and even understand the semantics of situations.

Ing. David Herman, RCE Systems

9 min

The transformation and management of modern cities is based on up-to-date data, which is collected by hundreds of millions of sensors installed all over the world. Although there are already a lot of sensors, the number is growing exponentially. One type of sensor that is both cheap and provides a rich array of information is the camera. On the other hand, cameras generate incredibly large volumes of data. This data needs to be analysed in real time, ideally as close as possible to the source in order to minimise data connectivity demands. This is where artificial intelligence comes into play. It can recognise individual objects in the video, track them and classify them. Artificial intelligence turns cameras into universal and widely used sensors, becoming the cornerstone of smart and safe cities.

Cameras and AI

The technology used in cameras has advanced greatly over the past decade. Image sensors now have increased resolution, lens speed, sensitivity, dynamic range and a wide array of other parameters needed to capture high-quality images under any light conditions. After they were invented, cameras captured the stories of people. And humans were the only ones able to view and understand these recordings. Further advances in digital technology gradually made room for new applications. Surveillance cameras became the eyes of monitoring centres and the sensors of dumb, purpose-built machines. Now we are entering a new era where machines are starting to understand images.

After they were invented, cameras captured the stories of people. Then surveillance cameras became the eyes of monitoring centres and the sensors of dumb, purpose-built machines. Now we are entering a new era where machines are starting to understand images. What comes next?

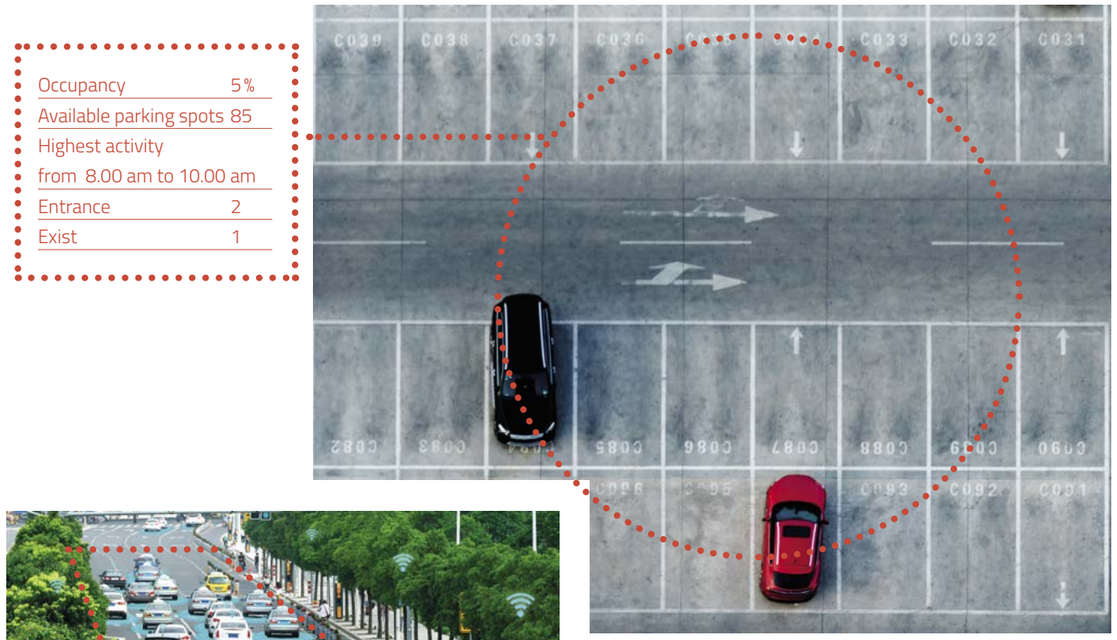
And being able to do that means a lot in our world. If you can make sense of images, that means you can drive a car, recognise faces and measure, analyse and control the world around you. With the arrival of deep learning, the ability of machines to interpret visual data has reached an entirely new level. With the help of massively parallel processing systems that model adaptable biological neural networks, it has suddenly become possible to solve tasks that were previously hard for machines to grasp, such as vehicle detection or semantic understanding of visual scenes. In which situations can cameras be utilised?

Adaptive Intersections

In many areas, the dramatic increase in car traffic we have seen in recent years exceeds the capacity of the transport infrastructure. However, traffic congestion is not a sufficiently strong impulse for motorists to stop using cars and start using public transport more. Increasing the capacity of road networks through construction work is an extremely expensive and time-consuming solution. Another way of improving traffic flow on existing roads is ensuring more efficient traffic control. A key element of the solution is making traffic lights at busy intersections adaptive, meaning that the traffic signal plans change according to the current traffic situation. Smart intersections use a network of sensors to constantly measure and evaluate the demand for green lights, record long-term statistics and communicate with the controlling system. The commonly used types of sensors, such as induction loops or radar units, can also be replaced by a camera system. Traffic cameras can detect vehicles as well as pedestrians and cyclists, who have a significant impact on the flow of traffic. Smart camera systems can label objects and then pass the labels to other cameras. This enables them to track objects and record their complete trajectory through the intersection (in the form of an O/D matrix). The controlling system that analyses the recorded trajectories then automatically identifies busy sections, traffic conflicts or anomalies (such as accidents or stopped vehicles). Moreover, cameras can also provide live video feeds for visual checks in traffic monitoring centres or provide video recordings that can be used to determine the reasons for road accidents. These features, together with their low cost, are some of the reasons why cameras are becoming increasingly popular in this sector.

Convenient Parking

In addition to traffic congestion, increasing car traffic also makes parking in cities problematic. There are a number of ways in which the detection of free parking spaces can be approached, whether it's predictive models or sensor-based solutions that provide real-time data. What makes cameras with AI better than road surface sensors? There are several reasons. A camera acts



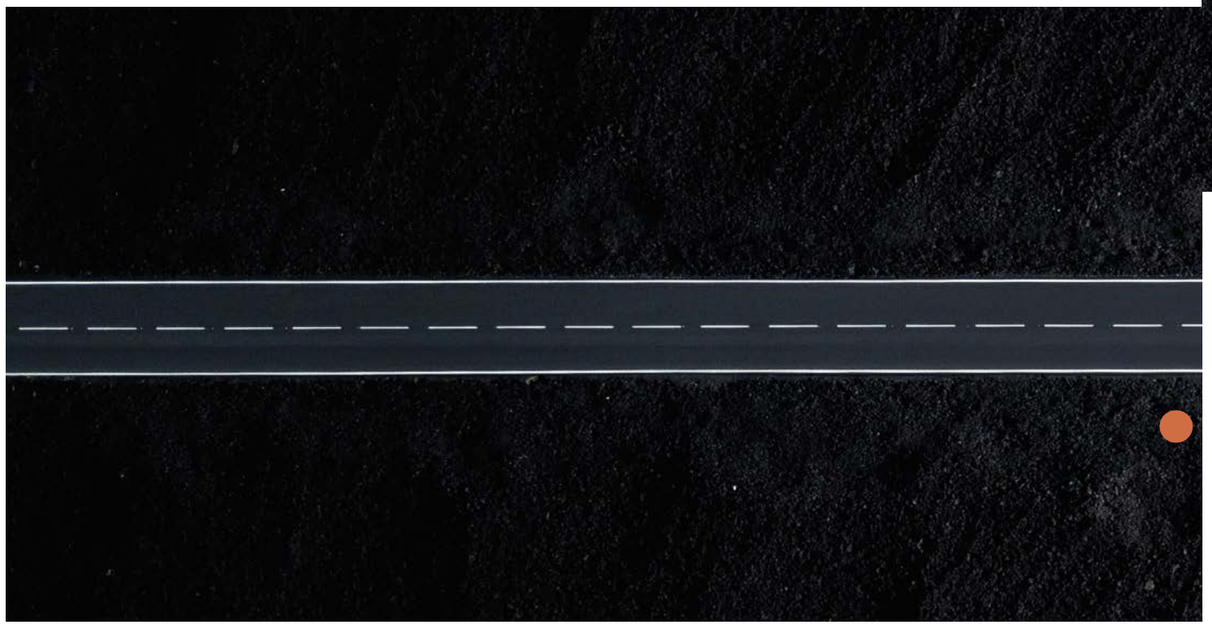
as a single sensor that covers tens or even hundreds of parking spaces (depending on the parking lot layout). Not only can it use algorithms to detect whether a parking space is occupied, but it can also classify the object present there. This combination of features enables the creation of comprehensive parking policies, thus making the use of parking areas more efficient (through the monitoring of reserved parking spaces, detection of vehicles that are blocking the way, etc.). Cameras also ensure a passive increase in security and they can be linked to the police. Algorithms make it possible to identify vehicles using their number plates, allowing for policies that, for instance, provide benefits for local residents. This approach is also more reliable since cameras are produced on a mass scale and, unlike sensors, this method does not require cars to be parked perfectly in order to be detected. Then there is the question of how many devices need to be managed. Thus, if it is used on a large scale, a camera with computer vision algorithms can potentially be a much smarter parking solution than the technology used currently.

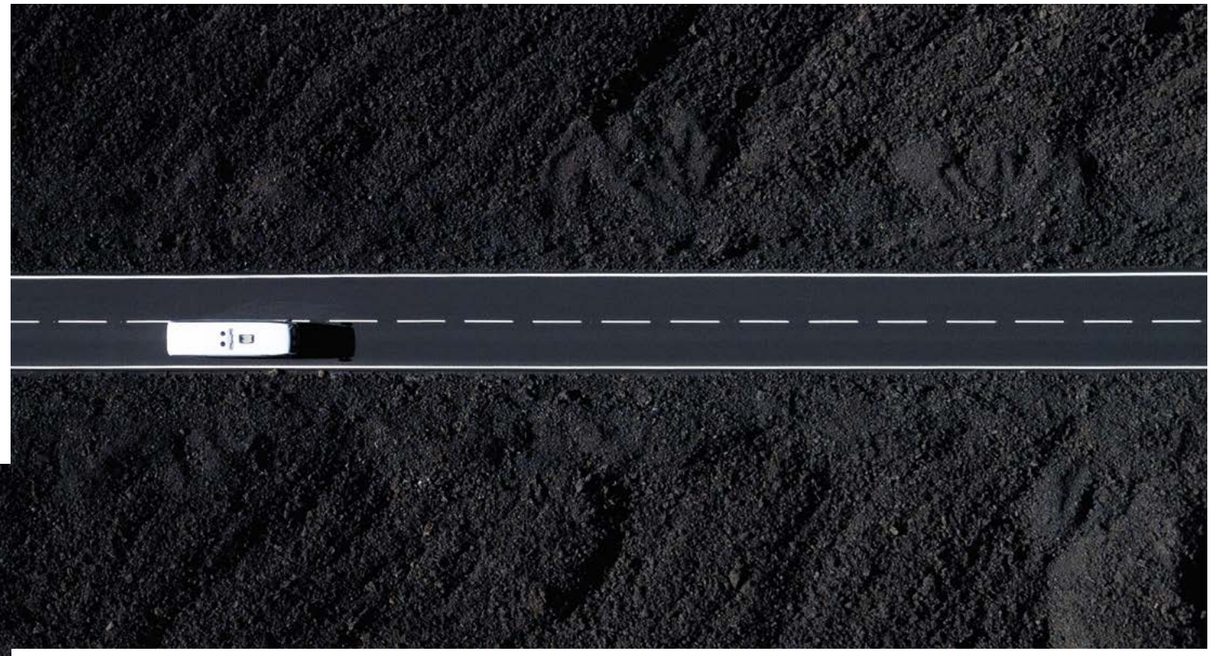
Smart Streets Need Smart Lighting

Street lighting is one of the main platforms where networks of smart city sensors can prove their worth. It offers the sensors perfect coverage of the city, a constant source of power and it is usually managed by a single entity. Street lighting and cameras are a match made in heaven since they share a common denominator, i.e. light. Street lamps provide the light that cameras need. This means that all cities have a system of elements that are directly optimised for the collection of visual data through smart lighting. And how can it be utilised? In many ways: to analyse the use of public spaces, monitor traffic or even increase security through algorithms that detect anomalous situations. Does this sound like science fiction? Modern cameras are tiny devices that can easily be integrated in lamps. For a single camera, the power required to run a processing unit for real-time use in neural networks is currently around 10 W. This makes cameras are a promising tool that can be used to build smart streets.

Flying Cameras

Cameras have also become the primary sensor of unmanned aerial vehicles, or drones. Drones gave cameras wings to fly, creating the perfect mobile monitoring system that can offer a completely new perspective on the things around us. Seeing a scene from a bird's-eye view has many advantages. Obstructions of view are minimised and the viewpoint provides ideal accuracy for the localisation of ground-based targets. Data from such a system can be so accurate that it can be used for advanced analysis of traffic conflicts, which makes it possible to analyse the safety of an intersection by studying the interactions between individual entities in the traffic flow of a specific area. This technology enables a completely unique approach, practically making it possible to detect accidents before they even happen. Even in this context, the surface that the drone-carried camera can cover plays a big role. A camera with 4K resolution can cover a length of as much as 700 metres, which is a sufficiently long section to enable automatic recognition of aggressive behaviour, violations of minimum distances between vehicles, etc. Just like traditional systems of cameras, which can identify a target based on visual minutiae and position, even drones can be used in larger numbers to cover a bigger area, such as a city district. This approach is already utilised by research projects.





About Company

RCE Systems is developing market-leading, cutting-edge technologies in robotics, computer vision, and embedded systems. The core value of company is technology innovation; therefore, RCE supports and cooperates on various academic projects (e.g. Roboauto, TU Brno Racing, etc.).

The company is continuously growing and establishing amazing partnerships with leading companies, universities, and community-based organizations, thanks to what RCE Systems provides the skill and expertise to design, implement, integrate, and verify complex mechatronic systems.

The core activities of RCE Systems in the field of smart city solutions are traffic, parking and public space security. The company developed and operates its own optical localization system, gesture recognition system based on analysis of top-view depth data as well as traffic monitoring systems.

The Supersensor of Modern Cities

Progress in artificial intelligence used for object recognition in images and understanding scenes has redefined the camera as a generic sensor that can be used for a wide range of tasks, even outside of smart city contexts. The camera is becoming a supersensor with a broad array of applications. Its precision is not determined purely by hardware, but mainly by algorithms. This approach is based on the extraction and mining of data from images. We know that these tasks have a solution because we ourselves are proof that such a solution exists. We also have a very good understanding of the limits that camera systems have, which are determined by their physical nature. We are slowly approaching a time when understanding images will no longer be the exclusive domain of living beings. Are we on the brink of an age of cameras? Autonomous vehicles, smart streets, intelligent drones, identification based on facial recognition… These are only some of the areas where cameras lead the way among sensors.

5G Takes Many Smart City Concepts from Theory to Execution

Milan Zmeko, OMS

7 min

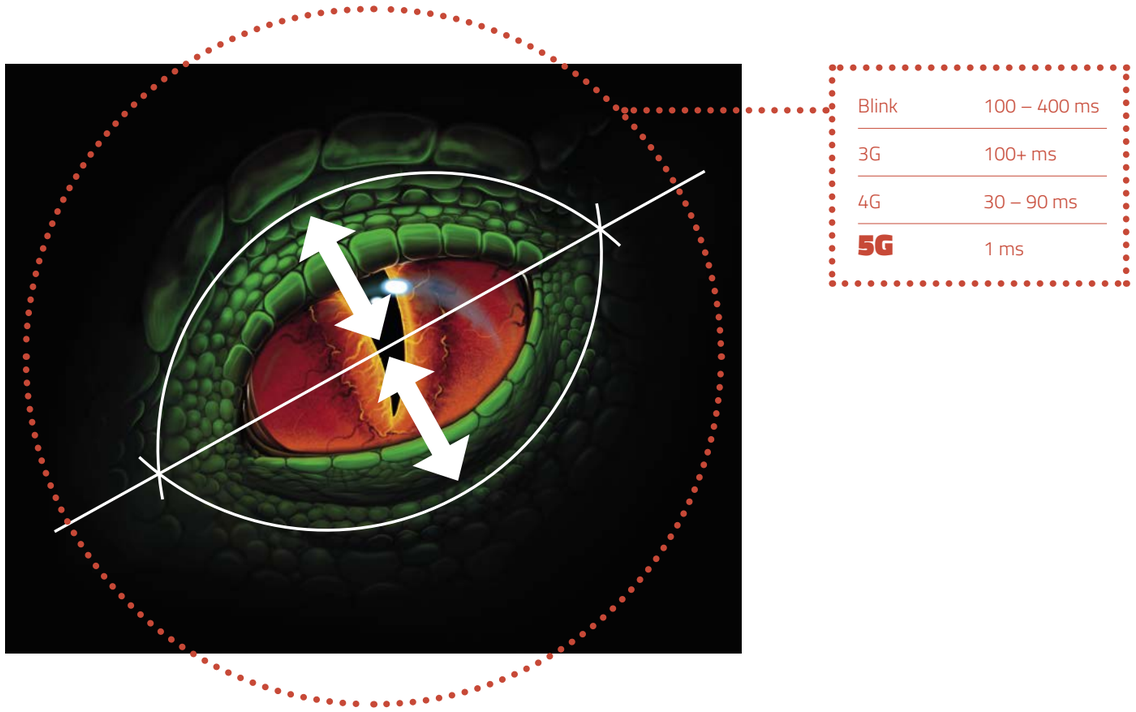
Fifth Generation Networks

Have you heard the joke where Facebook, Wikipedia and Google are arguing which one of them is the most important? In the end, electricity steps in and shushes them because none of those three would exist without it. In the process of building smart cities, a similarly important role will be played by 5G Internet.

4G is constantly trying to improve its undeniable qualities. However, it is obvious that the development calls for a new generation of networks and the operators will have to transform their entire infrastructure to its very core for it.

The current developments in wireless technology are governed by an identifiable algorithm. In practice, it means that every ten years a new technology arrives that is ten times better than the previous one. The Internet is proof of this theory. Every single generation of wireless networks has brought about improvements in the quality of services, more applications, increased user comfort, greater efficiency as well as new service providers and customers.

In the 1980s, 1G came and helped develop voice services. Ten years later, 2G brought basic data services. Then came 3G, which solved the problems that the previous generations had not been able to tackle. It increased the transfer speeds and improved the compatibility of various technologies. When 4G arrived, it increased the transfer speeds tenfold again, expanding mobile services and improving the user experience by allowing HD video playback on mobile phones. And while it is constantly trying to improve its undeniable qualities, it is now more than obvious that development calls for a new generation of networks – ones that enable the creation and sustainable development of smart cities.



Blink	100 – 400 ms
3G	100+ ms
4G	30 – 90 ms
5G	1 ms

Why “Smart” Needs 5G

The smart city concept answers many questions closely connected with the urban and environmental changes that have recently become increasingly intensive and will further increase in urgency in the near future. It also provides a real-world manual on how cities can cope with growing urban populations, address the increasingly dense traffic, improve the quality of the environment, ensure the sustainability of resources and generally improve the quality of life of their inhabitants.

It is now undeniable that a key role in the implementation of this manual will be played by various types of IoT technology which will work together based on the principles of connectivity and interoperability: various sensors, cameras, drones, parking equipment, dynamic lighting systems and data storage. All of these devices will share a common trait: a huge thirst for extremely fast and stable connections with low latency, which will enable them to receive and send huge amounts of data in real time and respond to it immediately.

5G wireless networks are the perfect technology to address this need. They will enable mobile connectivity with speeds of up to 10 Gbps and latencies lower than 1 ms; that is 100–400 times faster than the blink of an eye. In other words, this connection will be multiple times better than the current broadband cables and it will even be more energy efficient than the modern 4G/LTE networks, which, in practice, only provide speeds of several hundred Mbps and latencies between 30–90 ms. However, achieving these parameters requires a completely new network architecture, which is why telecommunications operators will have to transform their entire infrastructure, from endpoints (transmitters) to its very core. And the question of infrastructure needed for 5G networks brings us back to street lighting systems.

Universal Infrastructure

Some of the most important requirements of 5G infrastructure state that it needs to be comprehensive and flexible. Terminal equipment, such as transmitters and receivers, will no longer be placed exclusively on tall roofs and long-range towers. In practice, this means that each street will include several transmitters – especially on street light poles. These have many advantages: they do not need to be constructed for this sole purpose, they are placed in dense networks and are at regular distances between one another, they have the appropriate height for transmitters and, last but not least, they have the required electric infrastructure and they will eventually also have data infrastructure. Moreover, street light poles can be found everywhere where there are people or important transport nodes. These are exactly the places that require connectivity.
It has already become clear that the requirements to operate a 5G network are the same as certain types of communication needed for smart street lighting or other equipment that will be placed on street light poles in the future.
According to preliminary estimates, one in 20 points in the street light network (either a lamp pole or the lamp itself) will have 5G infrastructure attached to it. Studies show that telecommunications operators will be willing to pay monthly operating costs of up to USD 350 for each one of these points. In February 2017, for instance, the German semiconductor manufacturer Infineon and a provider of street lighting smart solutions announced a partnership that would focus on the development of street lights with 5G connectivity that communicate with a scalable sensor hub. In the near future, there will be more partnerships like this one, benefiting both parties. Connecting 5G networks with smart street lighting makes the development of both technologies easier and faster.

Indoor Lighting Systems Can Help Too

In addition to streets, the advantages of connecting lighting infrastructure and 5G networks can also be seen indoors. Providing 2G or 4G/LTE coverage for buildings, such as business centres, shopping malls and residential buildings is very problematic and expensive. However, 5G networks use a different architecture, enabling new ways of providing so-called indoor coverage, which will make implementation easier and reduce costs. Indoor 5G transmitters have similar placement requirements as indoor lighting, so it makes sense for these two infrastructures to be installed together. As a result, the principle that a need for lighting is associated with a need for mobile connectivity is even more relevant inside buildings.

5G As a Requirement and Activator

Despite its undeniable qualities and the effort to improve its parameters, 4G Internet will not have the capacity to carry future data traffic, which will grow exponentially along with the implementation of smart city concepts. We already know that the number of devices that will require wireless network connections will grow from millions to billions in the coming years, with further growth expected later. Not to mention smartphones and computers. This initial phase only concerns the IoT devices that will enable our municipalities and industries to become smart.

The first wave of the 5G network implementation will have immediate and tangible benefits for citizens thanks to communicating IoT devices and AI: improved security, efficient waste management and energy, smooth traffic and simpler parking. In the near future, 5G can also increase the number of self-driving cars since the vehicles need to be able to communicate with each other in real time with low latency.

Practical applications of 5G wireless connections prove that 5G Internet plays two different roles in the “smart” transformation of municipalities and regions: not only is it one of the most important technological prerequisites for future settlements, but it is also an important activator that will directly influence their sustainability and the citizens’ quality of life.

Smart Navigator

Ing. Radovan Slíž, CEO, OMS

9 min

How to Successfully Navigate the Transformation Process into a SMART Port

Municipalities, cities and entire regions are beginning to see that smart concepts allow them to function effectively and to engage their citizens for their benefit. However, since these concepts are still a novelty in CEE countries, the transformation initiatives do involve some risks. Therefore, we have developed the SMART NAVIGATOR web application, a compass that will help cities and municipalities stay in the right direction while transforming into smart self-government.

Looking at the practice further west, it is evident that a good smart city can be defined as a city or municipality that uses technology for collecting, evaluating and processing information to achieve a more transparent city management. Information from different areas of urban and municipal life is connected in one place and provides a clearer picture of the current state of self-government, its needs, visions and plans. Technologies help people live a better life and control the quality of self-government services.

Today, it's already clear that we're on the threshold of a period when transformation processes focused on smart concepts will experience a boom. Therefore, it is even more important to realise that the changes that will come cannot happen spontaneously or randomly. On the contrary, they must be approached in a conceptual and structured way, respecting the individuality and needs of each self-government. And that is where the biggest risk accumulation occurs.

Due to a wide range of technologies, cities often have a hard time selecting the right ones or the correct order of their implementation. For the smartification process to have the desired efficiency, it's not a good idea to start with uncontrolled testing of individual technologies and solutions. By doing so, each municipality is risking that if the number of the technologies is inadequate, their subsequent integration will be very difficult, if not impossible. Because every citizen, self-government or region expects a functional ecosystem of technologies and solutions that are aware of each other and that can cooperate with each other.

Smartification is not a project with a fixed start and end frame. It's a process that needs to be launched and its limits must be flexibly adapted according to partial results and responses. If you don't know where to start, try considering the following points. Irrespective of how big of a self-government you are, these points represent the minimum you have to deal with in your smart city project.

Cities often have a hard time selecting the right technologies or the correct order of their implementation. And that is where the biggest risk accumulation occurs.

1 Start with a realistic vision

Any responsible city, region or city district leadership should define and update its short-term and long-term strategy and goals, identifying the priorities and objectives of its activities. Start with a realistic vision of where and how you want to go. There are many devices and many different smart city definitions and no two implementations are the same. Clearly define your urban, social, economic or other goals. Define your budget and plan your projects. With a good smart city platform, you don't have to worry about pilots. You can have them integrated in a platform right from the start, and after testing them in roll-outs, you'll be very comfortable with them because you'll already know and understand the solution.

2 Implement IoT architecture and infrastructure with the following features: open, secure, scalable, interdisciplinary, pro-integration

The most difficult task awaits you when creating the infrastructure. To avoid trial-and-error solutions, do it right the first time. Ideally by using existing public lighting infrastructure. Find solutions to help you transfer data, e.g. over electrical wires (PWL technology). Where cables fail, use air transmission (e.g. RF technology). Mobile SIM connection now seems equally favourable, but over time it's necessary to count with an increase in connectivity charges or data traffic, which can generate additional costs. Many times, life will show that it will be necessary to combine these technologies. Good infrastructure must be scalable, manageable and secure. Remember that you are laying the foundations just like when building a house. If you make a mistake in this part of the process, the whole house may come crumbling down over time or you'll have to spend a lot of money on corrections.

3 Think big and long term, but take it step by step

The basic parameter for Smart City solutions is long-term sustainability and continuous development with regard to the protection of investments. Therefore, it's a good idea to simultaneously implement solutions with long-term objectives and multiple connectable small solutions with potential for the rapid onset of benefits for the citizens of the city, municipality or region.

4 Launch and support your initiatives

Existing methodologies that evaluate the current city position (e.g. smart index) will help you design a road map and areas for smart city implementation. They work with a lot of data and indices that determine the city's position and, if necessary, compare it to the position of cities of the same category. It's very important that the methodology takes into account the characteristics of the region and the objectives of the city.

5 Identify clear milestones and find metrics – KPI, ROI, etc.

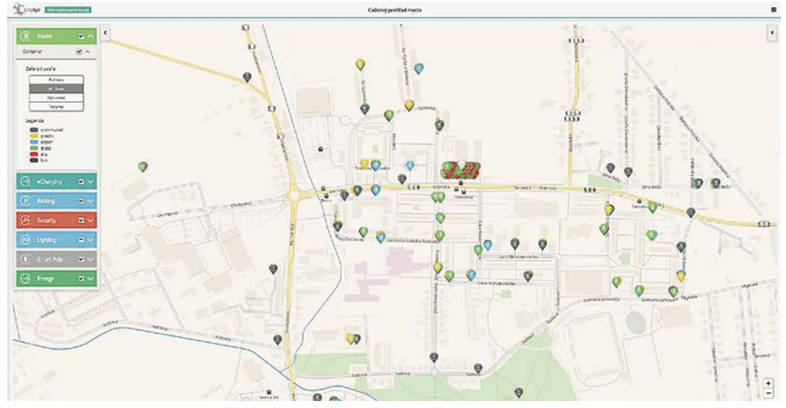
Once the road map is established, it's necessary to understand the context and causes of the current state of the named initiatives in practice so that the implementation road map is as close to the practice as possible. Individual areas of the city complement each other and have a lot of interaction and dependency with each other. In addition, the city's representatives often operate with hypotheses about the causes of the current state rather than with data-supported facts.

For a better understanding of the current state and its causes, we recommend setting up a collection point and a central point of visualisation of the city's state, i.e. building one of the cornerstones of the city's future operation centre (Intelligent Operation Centre), specifically an Operation Management Dashboard, which provides an operative view of the city's situation and should include data from an existing facility base and a smart device building plan. It is often advisable to add additional sensors and data sources to the existing devices to supplement the measurements, to refine the findings or to test a particular technology.

Another powerful tool in the city's Intelligent Operation Centre are analytical views of the city (Urban Data Aggregation & Analytics) to analyse the situation in the city by the appropriate visualisation of the area. An example may be the analysis of the traffic development over a period of time by visualising the movement of selected objects and loads in individual parts of the city.

6 Discover open data and learn to work with it

An essential part of building a smart city is creating data (not just open data) and making it available for further use by various entities and systems. Open data provides space for the city to create appropriate data sets, allowing for new solutions, views and applications. Of course, the topic of open data is very broad. It is certainly effective to think about which data files will be freely accessible, which ones will be available for a fee and which ones will not be accessible at all for security reasons. With a well-designed concept, it is very easy to see which types of data you're currently lacking, and this information may serve as a basis for further initiatives. However, it is a broad topic, which we'll certainly go into in greater detail later.



Operative overview of the city, simulation – Senica nad Myjavou

7 Define and include smart solutions in monitoring and management

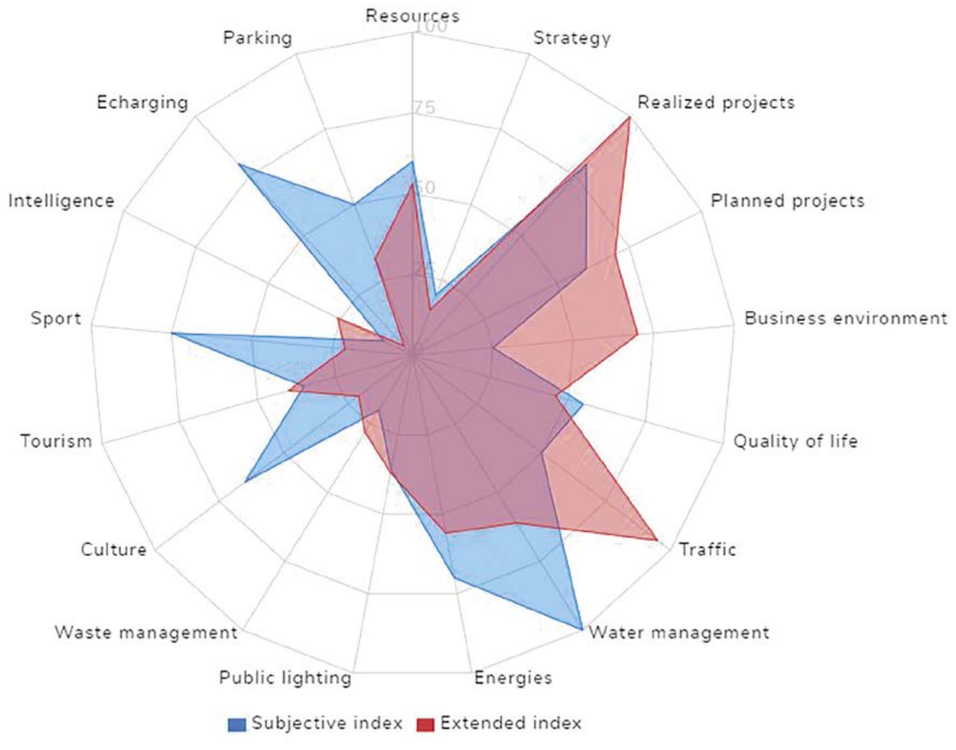
Smart city management has at least two levels. The first level of management includes a smart city solution for a selected domain, such as managing public lighting or waste collection. Each such level of management is the responsibility of different actors and it is a good idea to deploy a solution for each area separately.

The second level of smart city management means the definition and management of interdisciplinary scenarios in the city among the individual systems of the first level. An example could be the interconnection of security and public lighting (e.g. increasing the intensity of lighting in the event of a security risk situation). To successfully implement this level of smart city management, it is important to define the services and data provided by individual first level systems and also to have an effective tool for defining interdisciplinary scenarios and their managing in real time.

8 Stimulate ecosystems and coordinate collaboration between them as well as between the state, the private sphere and municipalities

A smart city is basically an ecosystem of solutions that work together which has other benefits (not just informational ones). When creating key documents for the implementation of smart city concepts, it is recommended to set up an advisory body for the city (City Council or Stakeholder Forum), in which key ecosystem players are represented and which will be responsible for defining the vision, concept, objectives and key initiatives of the smart city implementation.

Smart index display (web application Smart Navigator)



The most common models of city responsibility and engagement are the following:

- "Build, Own, Operate", where the main supplier is the city itself or its affiliated organisation that provides smart city services, so that operation and maintenance are completely under the control of the city;
- "Build, Operate, Transfer", where the city appoints someone who is responsible for building the smart city infrastructure and systems, and then the city takes over and operates these services and infrastructure in a defined scope;
- "Open Business Model", where the city allows each qualified company to build infrastructure and provide urban services according to defined guidelines and regulations;
- "Public-Private Partnership", in which the city works with private sector partners to build smart city infrastructure and systems.

The initiatives of building a smart city are the key areas where the use of smart city technologies and concepts will help the city accomplish its strategy and goals. It is only a matter of time before smaller units (municipalities, cities) begin to connect to larger units of micro-regions, regions and maybe even whole countries.

9 Create a city for people, engage them in the whole process as much as possible and obtain their lasting interest

Search for inspiration in nearby abroad. Create a discussion and workshop space for all levels of the population. From laymen, through civic activists to the professional community, which can be the initiator of interesting start-up solutions.

10 Connect the whole city and all citizens using portals, social networks and tools that you created (crowdsensing, feeling maps, e-government communication) and celebrate every success

Smart Navigator Holds the Direction

Smartification is a process that contains many new concepts and procedures and requires a bit of thinking outside the box. And I don't mean just "smarter". Smartification really opens up new horizons of services for citizens, new business scenarios for municipalities and cities and, last but not least, for local businesses. To make this journey sustainable, to avoid repeating mistakes and to make use of the best practice, you can use the Smart Navigator web application (smartnavigator.city) as a compass. It will help you understand the technological context and the process correlations – what do you have to do to get such and such service or control in your municipality; what happens if you do this, etc. Smart Navigator works with general classification and categorisation that covers the possibilities of the municipality/city regardless of its size or belonging to a region.
Smart Navigator can also be used as a lightweight, easy-to-use and illustrative textbook of individual benefits and planned initiatives. The individual areas are accompanied by clear texts and short videos that even a layman understands. It also offers a list of possible ways of implementing smart city elements that are based on a pragmatic approach and efficient use of financial and human resources, along with the gradual recognition of the benefits and challenges of the individual technologies.

SMART NAVIGATOR .CITY

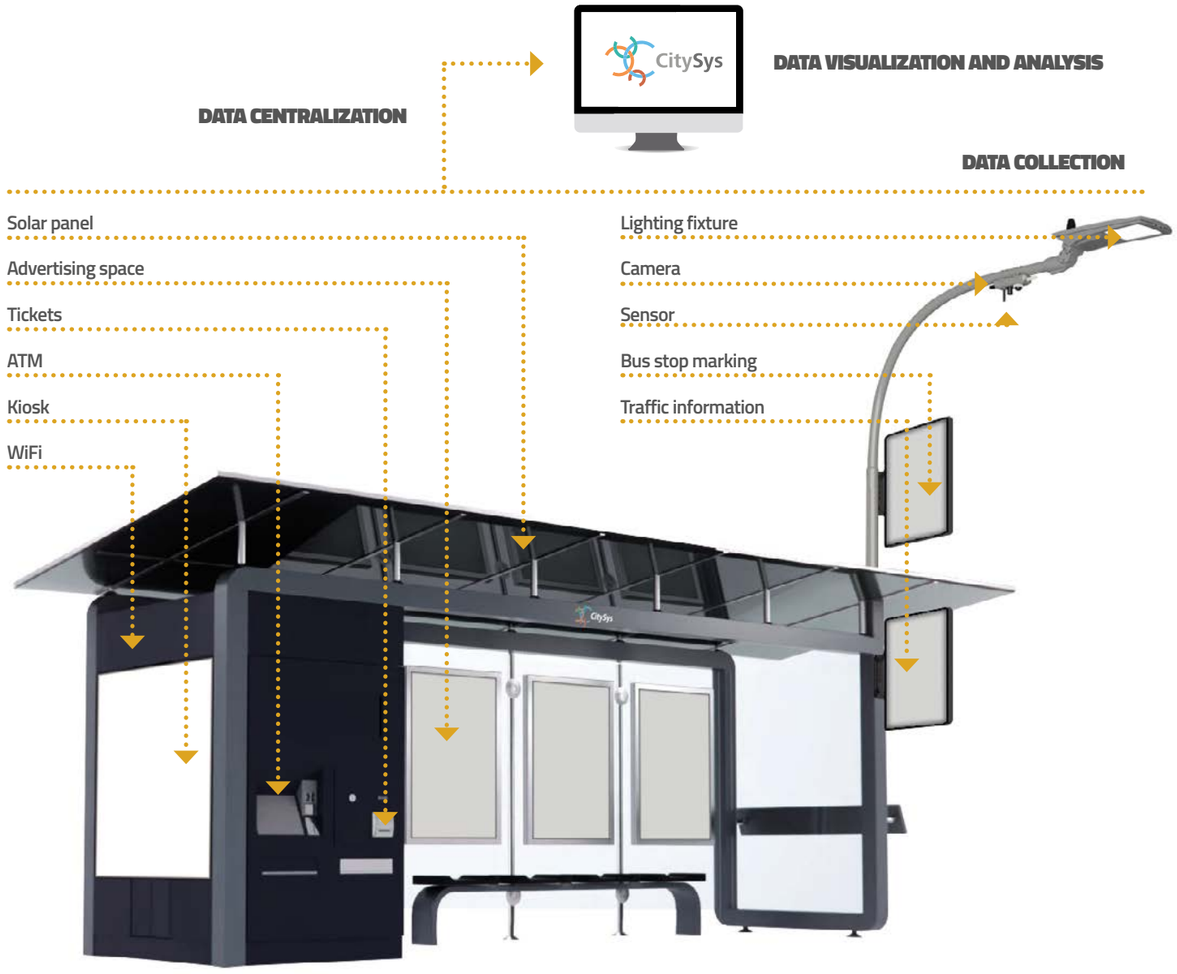
Smartification is a process that contains many new procedures and requires a bit of thinking outside the box. And I don't mean just "smarter".

Smart Bus Shelter

Bus Shelters Are Changing to Service Stations

3 min

Cities and municipalities face many challenges in this age of digitisation. Such challenges include citizen requests for services that can accommodate their daily needs. The most frequently cited neuralgic spots include access to too little information, lack of Internet connection in public places, heavy traffic and damage to property. An intelligent and affordable solution that can cope with these challenges is the Smart Bus Shelter.



The one advantage of the Smart Bus Shelter is that in can quickly replace outdated models at any time in an existing infrastructure.

The Smart Bus Shelter is a part of CitySys, the comprehensive solution that OMS, a.s. developed in cooperation with their partners. This new bus shelter model offers many practical functionalities. There are integrated payment devices for the sale of public transport tickets and information boards that show route, arrival, departure information and traffic news.

There are also e-bike chargers, self-serving food and drink vending machines, sensors for monitoring air quality or noise and a security camera. There are heated benches and seats to increase passenger comfort, Wi-Fi and digital advertising LEDs are a standard feature, presenting the municipal authority with a commercially interesting product with monetising potential. Moreover, the Smart Kiosk, an integrated interactive terminal, provides access to information, apps to communicate with the city, shopping, entertainment or education.

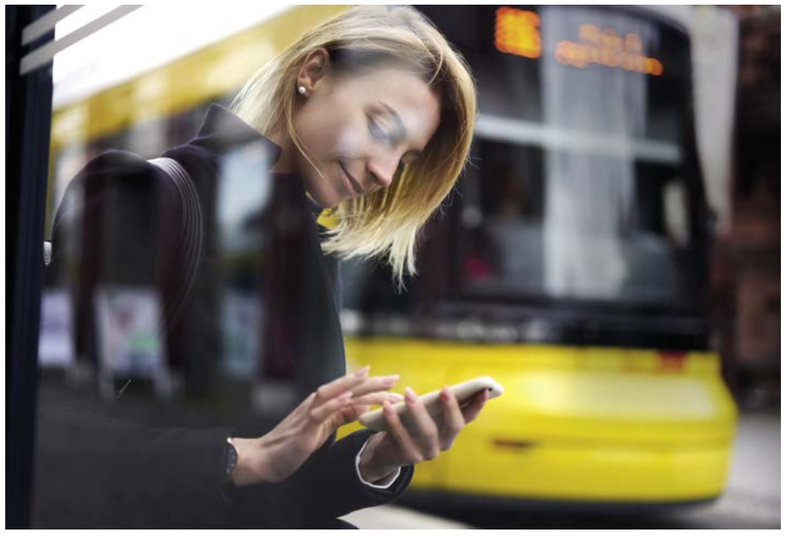
The Smart Kiosk was developed with people with sight or physical impairments in mind and all the services are adjusted to their comfort. The option to allow and block websites is designed to prevent children from accessing inappropriate contents online and from exploiting the Internet connection.

Data Collection and Management

The bus stop can be managed via remote administration. The city or municipality may analyse all the collected data and use the analysis outputs to increase the efficiency of their operation. As the software can access several devices at the same time, the provider may aggregate data from various shelters into a single data storage. CitySys runs on a widget system that allows the user to manage and edit the graphic user interface according to their needs and use the collected data or events in future analyses. The GUI is designed to enable simple orientation without any issues for the user. An interactive system map shows all the available devices on the map in which it is possible to monitor the state of the device, camera records, information about the solar panel, or information statistics about the displayed sites of the Kiosk. The system has many functions which secure easy operation, fast access to data as well as collection of very important statistics.

Use and Optimise

The one advantage of the Smart Bus Shelter is that in can quickly replace outdated models at any time in an existing infrastructure. Fast-growing cities and municipalities can, in turn, implement it as part of a new infrastructure or use it to re-evaluate and modify public network transport routes. The Smart Bus Shelter can accomplish a large number of tasks easily and efficiently, literally turning a regular bus shelter into a service centre where a citizen gets access to a range of services in one place.



Smart City Vocabulary pt. 3

Every Single Word You Need to Know to Understand The Whole

Another useful terms from the field of Resource Management Processes, Technology, Infrastructure, and Governance you should know inside out before you start to design the first draft of the Smart City Project.

RESOURCE MANAGEMENT PROCESSES

Footprint
effect of a behaviour or a set of resource demands on a particular set of systems with which it interacts

Lifecycle
stages and activities spanning the life of the system from the definition of its requirements to the termination of its use covering its conception, development, operation, maintenance support and disposal

Renewable Energy
energy from a source that is not depleted by extraction, such as solar energy (thermal and photovoltaic), wind, water power, renewed biomass

Resource Efficient
using the Earth's limited natural resources sustainably to minimize environmental impacts, enabling the creation of greater value with less input

Smart Community
community that maintains or improves its quality of life sustainably by minimizing its environmental impact, using natural resources and applying policies of renewal and replenishment, and running its economy and social life so that growth is decoupled from increasing and non-sustainable exploitation of natural resources

Smart Energy Installations
community, or locally sited energy generation, distribution and consumption of energy schemes, using low – or nil – carbon emitting technologies in combination with electrical and heat storage technologies

TECHNOLOGY AND INFRASTRUCTURE

Access Control
prevention of unauthorized use of a resource, including the prevention of use of a resource in an unauthorized manner

Active Infrastructure
live network equipment for receiving, transmitting or distributing digital data and information

Application
<in networks> system, including its associated transmission method, which is supported by telecommunications cabling

Bandwidth
data transmission rate of digital media

Broadband
high-speed, "always on", internet access

NOTE The necessary bandwidth is the amount of spectrum required to transmit the signal without distortion or loss of information. FCC rules require suppression of the signal outside the band to prevent interference.

Broadband Connectivity
high-speed internet access at speeds of hundreds of kilobits per second

NOTE Broadband speeds are now more typically several 10s of Megabits pe second (Mbps), up to c.100 Mbps.

Co-existence
existence of objects and applications in the same environment with no conflict with one another

Configuration
set of status parameters for an object or device

Configuration Process
configuration of parameters of an object or objects or applications

EXAMPLE The association of objects in a device with those in other devices

NOTE This may be carried out by means of a configuration tool and other actions that may be automatic and driven by other services and IoT applications

Internet
worldwide interlinked computer systems and computer networks connected via gateways that enable the transfer of data between them

Internet Service Provider (ISP)
commercial supplier providing access to digital content and services

Interoperability Framework
standard that defines what object (device, network, application, driver, thing) information must be available to systems for them to use them as part of an interoperable process

Local Area Network (LAN)
network in which computers, printers and other equipment are connected and data are transferred within one network

Long Term Evolution (LTE)
standard for wireless communication of high-speed data for mobile phones and data terminals

Masterplan
set of documents laying out the plan and design, which takes into account every element of a city-wide development

Middleware
software which allows for interaction between two or more different software entities by hiding their structure and complexity from each other

Network
collection of computers and devices interconnected by communications channels that facilitate communication among users and allow users to share resources and services

Non-Repudiation
service providing proof of the integrity and origin of data (both in an unforgeable relationship) which can be verified by any party

EXAMPLE A digital signature may provide proof of non-repudiation as it links the sender with the message

Object
embodiment of information as data structures and operations upon the realized in electronic hardware, software, or embedded in a stream of data, that can be referenced and with which interaction can be achieved by processes, other objects and users

Operations
instance describing one complete procedure

Passive Infrastructure
non-active parts of the digital infrastructure

NOTE This includes cables and outlet sockets and contain no active elements to process digital data and content, but permit the transmission of the information

Platform
combination of an operating system and hardware that makes up the operating environment in which a program runs

Replay Attack
masquerade which involves use of previous transmitted messages

Repudiation
denial by one of the entities involved in a communication of having participated in all or part of the communication

Sensor Node
sensor network element that includes at least one sensor and optionally actuators with communication capabilities and associated data processing capabilities

Validation
act of examining information provided by a person (or a system) to ascertain what rights, privileges, or permissions they may (or may not) have to perform some action

Verification
<in cryptography> testing the authenticity of a digital signature by performing special mathematical operations on data provided by a sender, to see if it matches an expected result

NOTE If the information provided by the sender yields the expected result, the signature is valid, because calculating the proper answer requires secret data known only by the sender. Verification proves that the information was actually sent by the signer and that the message has not been subsequently altered by anyone else.

Wide Area Network (WAN)
network that provides communication services to a geographic area larger than that served by a local area network or a metropolitan area network

Wireless Mesh
network relying on all nodes to propagate signals

NOTE Although the wireless signal may start at some base station (access point) attached to a wired network, a wireless mesh network extends the transmission distance by relaying the signal from one computer to another. Used on the battlefield to provide path diversity, it is also used for sensor networks and personal computers

GOVERNANCE

Accountability
property that ensures that the actions of an entity may be traced uniquely to the entity

Civic Engagement
involvement and participation of various civil society organizations, stakeholder, communities and citizens in policy-making and public debate

NOTE 1 Smart city applications can enhance civic engagement, for example through shared online platforms. At the same time, smart city applications may run the risk of disenfranchising certain communities.

NOTE 2 "Civic stewardship" is the responsible planning and management of resources in the public interest. In cities, stewardship groups are organizations or groups of people who work to conserve, manage, monitor, and advocate for, their local environment, such as urban parts and historic sites.

Governance
effective co-ordination and integration of policy- and decision-making processes within and across organizational structures, assisted by relevant information and communication technologies and systems

Public Accountability
responsibility and public answerability of decision takers for processes and outcomes

NOTE The integration and co-ordination of complex urban systems through various smart city tools and techniques create additional needs for public accountability, to ensure the transparency and legitimacy of decision processes, outputs and outcomes.

Social Inclusion
implementation of policies and practices to ensure that all members and groups in society, particularly those in lower income bands, and those belonging to minority groups, can affordably access and use essential day-to-day rights and services

NOTE For example, employment, adequate housing, health care, education, training, digital access, etc.

Social Exclusion
exclusion from the prevailing social system and its rights and privileges, typically as a result of poverty or the fact of belonging to a minority social group

NOTE Social exclusion is about the inability of our society to keep all groups and individuals within reach of what we expect as a society. It is about the tendency to push vulnerable and difficult individuals into the least popular places, furthest away from our common aspirations. It means that some people feel excluded from the mainstream, as though they do not belong. For a long time, this has meant that inner city areas, and some large outlying council estates, increasingly vacated by people who can find an alternative, became a receptacle for problems (Power, A., Wilson, W.J., "Social Exclusion and the Future of Cities", Centre for Analysis of Social Exclusion, London School of Economics, London, 2000).

Transparency
openness of decision processes and outputs, enabled by the availability of information and data in accessible language

NOTE The introduction of smart city systems and techniques can make information more complex; at the same time, open and shared access to information can be enhanced through smart city applications.

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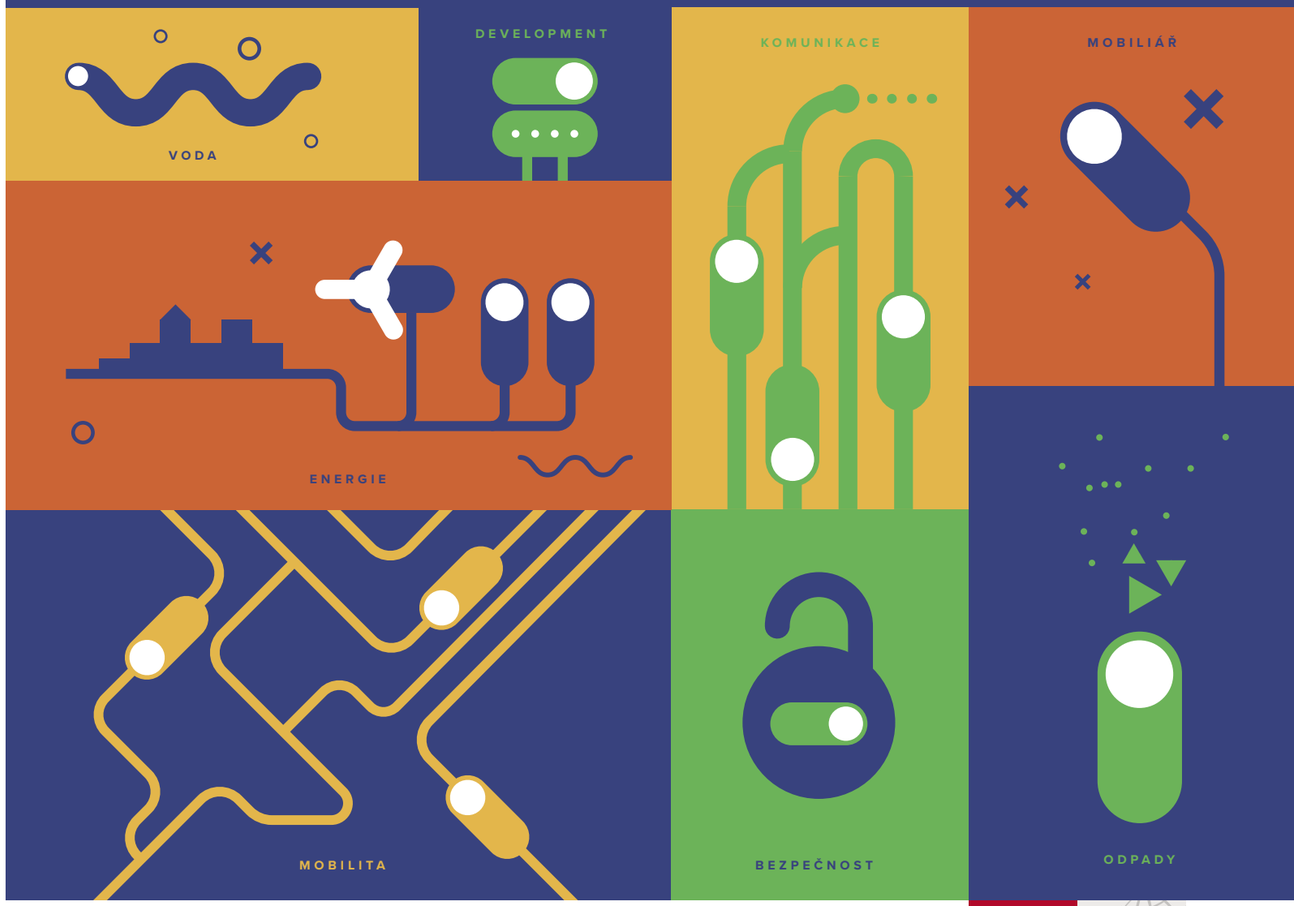

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APPLICATIONS

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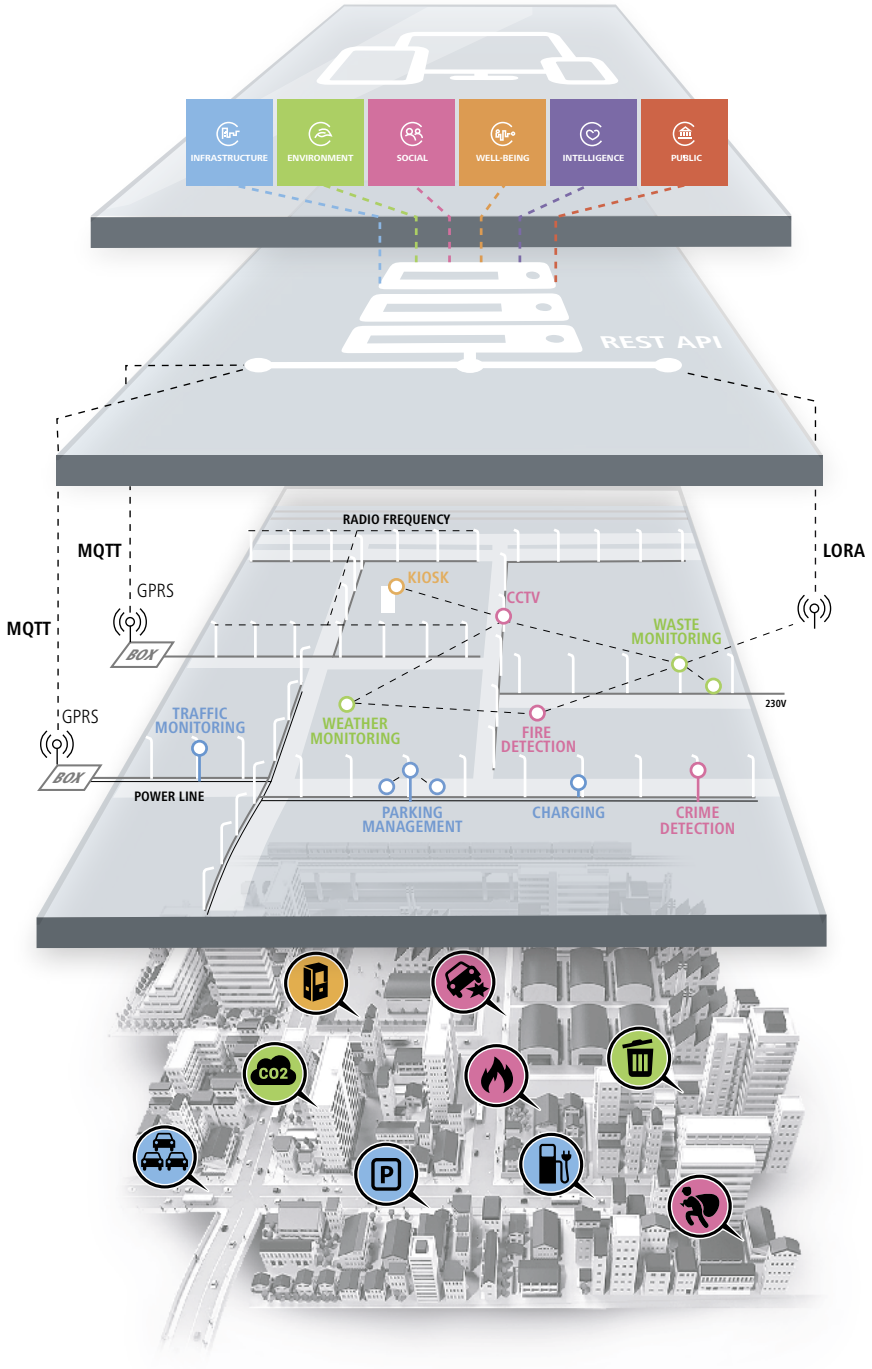
CITY



CITYSYS AS

Application provider by customisation and re-use of existing data, components and visualisation

Service provider by using open API interfaces from 3rd party applications and systems

Open data provider by getting data through interfaces and in BigData systems

Marketplace or ecosystem based on ability expands through partner's solutions