

SMART CITY MANAGEMENT

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ABSTRACT: Setting the goals to which we should aspire begins with the first question to be answered: What is a smart city? What are the goals of the smart city? Is it efficiency? Improved services? Improving the health of the residents? Improving the level of education and happiness? Strengthening the sense of community? The Happy Planet Index instituted by not defining business goals, but only where the residents are most content. It is necessary to establish a think tank for processing a methodology of holistic thinking, to serve the development of the smart city. The Smart City Administration that was founded at the initiative of the Ministry of Energy to address the subject of "sustainability in the urban space" is an important first step in this direction. It is important to learn from the experience of smart cities that has been accumulated worldwide.

KEYWORDS: Smart sustainable city, infrastructure, integrated management, cyber security.

I. PATHWAY FOR SMART SUSTAINABLE CITIES

Since the Iron Age, the human race has advanced steadily towards becoming a sophisticated manipulator of all factors of production. Man's move from agriculture to capitalization, industrialization and specialization of labour has led to growth in modern-day cities, bringing with it both positive and unwelcome consequences. Socio-economic growth has exploded at unprecedented rates, but alas, at equally unprecedented environmental cost. People are moving to cities for better educational and employment opportunities and higher incomes. The global urban population has been rising by an average of 65 million people annually during the past three decades, the equivalent of adding seven Chicagos a year. As of 2014, there are 28 megacities in the world, home to 453 million people. With 54% of the world's population now living in urban areas, cities are experiencing a range of different problems emanating from an ever increasing rural-to-urban migration. These include acute scarcity of basic amenities, environmental crises, and rising pollution levels — all of which threaten to burst the seams of already suffocated cities and their ageing infrastructure.

Projections indicate that these trends will continue. The total global population living in cities is expected to rise to 66% by 2050. Cities can usually account for up to 75–80% of a country's gross domestic product (GDP), and are considered the primary engines of global economic growth. The flip side, however, which may not be sufficiently factored in by city planners, is that cities account for 50% of global waste along with 60% of global greenhouse gas (GHG) emissions. There is increasing pressure on the availability of natural resources such as water, land and fossil fuels. There are now growing concerns about the viability of existing transportation infrastructure, the provision of adequate health care, access to education, and overall safety for the increasing population in urban areas.

II. INFRASTRUCTURE FOR NEW SMART SUSTAINABLE CITIES

In some countries, rapid growth in industrialization is causing populations to migrate from rural to urban environments, seeking higher paid employment. This trend started some years ago, and is expected to continue until at least 2050. While this situation exacerbates problems in many urban areas, it also provides opportunities for city planners to design new cities or districts starting from a clean sheet of paper. Until now, city infrastructure, and the incorporation of information and communication technologies (ICTs), has evolved in a piecemeal fashion, to meet the needs of "organic growth" as villages have grown into towns, and then developed into cities, fed by ever-increasing populations. Each new building or group of buildings has been planned and built at different times.

When city planners are embarking upon a new city design project, the following question is raised: “How should ICT infrastructure be planned for a new city, given that it has to be both ‘smart’ and ‘sustainable’?”. “A Smart Sustainable City” is an innovative city that uses ICTs and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental aspects. To begin with, a unique opportunity arises, when designing a new city, for the ICT infrastructure to be planned holistically. A comprehensive set of technical requirements must be drawn up, providing for growth and upgradability. Once planned, relevant specifications can be written, drawing upon the wealth of existing ICT specifications and standards. This approach assumes that the city or district is to be built with no existing structures above or below ground. This could save additional costs of retrofitting services, such as a sensor layer network and peripheral devices, which may be directly connected to the Internet, or more specifically, to the Internet of Things (IoT). Sensors may be connected directly to a source of power such as an electricity cable or metallic pair. Sensors requiring high bandwidth could be connected by optical fibre and stand-alone sensors, using wireless communication, which would need long-life batteries to provide power.

III. INTEGRATED MANAGEMENT FOR SMART SUSTAINABLE CITIES

Rapid economic development and population growth have given rise to a range of challenges to the sustainability of our societies and economies. Our cities are burdened by increasing pollution and traffic congestion. City infrastructure has struggled to advance at a pace matching urbanization, and the challenges resulting from the pressures of urbanization will be amplified by the increasing prevalence of extreme weather events that our cities will be forced to withstand as we progress further into the 21st century. The transition to Smart Sustainable Cities is a socio-economic imperative, and these cities of the future will be built on technical innovation and new approaches to city management. However, the rapid proliferation of technical and city-management solutions for Smart Sustainable Cities has bred a lack of uniformity in the application of these solutions. The solutions themselves are not at fault. Each has the potential to contribute to improved urban management, but uncoordinated implementations of these solutions has often achieved the opposite effect, increasing the complexity of urban management and thus diminishing its efficiency. City administrations have a wide choice of smart-sustainable-city solutions at their disposal. But ensuring the efficient organization and management of these solutions is of paramount importance if we are to realize the vision of Smart Sustainable Cities as a “system of systems” with benefits greater than the sum of its parts. Integrated management of city infrastructure, operations and citizen interaction will be one of the defining features of a Smart Sustainable City, and the importance of the topic is compounded by the power of management processes to ensure the success of all of a Smart Sustainable City’s components.

One of the best technical reports presents a framework for the integrated management of Smart Sustainable Cities which aims to identify or construct a set of metamodels, fusion processing workflows, and service interface specifications to facilitate the development of Smart Sustainable Cities. The report includes:

1. Technical specifications for resource metamodels, such as metamodels for nodes, events, models, sensors, and observations.
2. Technical specifications for the workflows of resource fusion processing, covering specifications relevant to the fusion of nodes, events, models, sensors, and observation resources with toponyms and maps.
3. Technical specifications for service interfaces, such as service interfaces for data, models, and events.
4. Use cases of integrated management for Smart Sustainable Cities, describing typical applications of smart-sustainable-city metamodels, fusion processing workflows, and service interfaces.

The framework and procedure for the integrated management of a Smart Sustainable City can be represented as events detected by sensors and recorded by observations. These observations would be analysed and processed by models, and this procedure would conclude with decisions made according to nodes. Events, sensors, observations, models, and nodes are the information resources of Smart Sustainable Cities. Integrated management seeks to improve the efficiency of city management through the metamodeling, fusion processing and unified servicing of these information resources. These information resources are represented according to the unified representation models of an integrated management framework. These information resources are then fused with one another to enhance or complement the information through the adoption of fusion processing workflows. It follows that these resources can be shared and managed through the uniform service interfaces of an integrated management framework. These five types of multi-

source, heterogeneous information resources (as depicted in the figure below) are indirect management objects of an integrated management framework. The relationships that bind together these information resources are essential in enabling comprehensive, integrated city management. Integrated management will help urban administrations to understand their roles and responsibilities in the operation of a Smart Sustainable City. Users of integrated management frameworks will access information resources very rapidly, locating exactly where events have occurred and taking precise actions in response.

IV. CYBERSECURITY: A SAFETY NET FOR SMART SUSTAINABLE CITIES

News media carry near-daily reports of high-profile cybersecurity incidents. Most organizations, in most industry sectors, will have suffered some form of cyberattack, granting the topic a vivid position in most of our minds and especially in those of leaders in the private and public sectors. A Technical Report on “**Cybersecurity, data protection and cyberresilience in Smart Sustainable Cities**” takes a direct approach to its discussion of the most prominent cyberthreats to smart cities. The report analyses the general technical architecture of a Smart Sustainable City to illustrate the complex security challenges faced by strategists and implementers. In analyzing the functional components of a smart city, the report pinpoints vulnerabilities in the security of the sophisticated technologies that make cities “smart”. Following an examination of the conceptual basis of cybersecurity, data protection and resilience, the report provides guidance on how to protect against, detect, respond to, and recover from cyberattacks. With the help of a number of sample scenarios, the report explores how any “smart” development needs to account for the fact that the information and communication technology (ICT) system managing these developments are inevitably and increasingly prone to cyberattacks, carried out by a diverse set of malicious actors, with varying motivations and with growing determination, sophistication and an expanding set of tools at their disposal. A key feature of this framework is its promotion of sustainable solutions to improve life in our cities. It provides for sustainable improvements to smart-city management, proposing an architecture characterized by scalability, fault tolerance and resilience to natural disasters and threats to cybersecurity. The proposed architecture builds on common standards to support interoperability between heterogeneous ICT solutions, assisting the integrated management of smart-city services, while also protecting the privacy of citizens as information flows between the various elements of a smart city. The “communications view” is another alternative to be considered, with this view taking into account physical networks (cable, wireless or sensor-based); connections (and appropriate interfaces); applications; and data distribution between users and the ICT subsystems of a smart-city system. This view also results in a multi-tier architecture consisting of all these entities. The capabilities of Smart Sustainable Cities will be enacted not only by traditional ICTs, but also by advanced emerging technologies including the Internet of Things (IoT), Radio-Frequency Identification (RFID), Machine-to-Machine (M2M) communications, Bluetooth®, Cloud Computing and Big Data. We are connecting more and more of the components of a city, exploiting the potential of networking to increase the efficiency and sustainability of city processes. Typical examples of smart-city applications include smart traffic lights and the incorporation of sensors in public and private vehicles to optimize traffic flow; mobile apps to report minor traffic accidents; smart energy and water grids; and smart meters collecting data on energy and water consumption. Numerous sensors and devices embedded within a smart city will give rise to unprecedented capabilities to deliver innovative new services to city dwellers. However, increasing ICT complexity and augmented connectivity — together with the vast amounts of data generated — will also increase the vulnerability of smart-city systems to both malicious cyberattacks and unintentional incidents. Every new device connected to an Internet address opens a new door to malicious attacks aimed at disrupting city services or gaining unauthorized access to data.

V. SMART WATER MANAGEMENT

Water is the natural resource most essential to the sustenance of life. A reliable supply of clean water is fundamental to human life, the operation of our economies and political stability. However, access to clean water remains difficult to achieve for a large percentage of the global population. United Nations’ estimates highlight that 85% of the world’s people live in the driest parts of the world, around 783 million people do not have access to clean water, and almost 2.5 billion people lack access to adequate sanitation. Our growing demand for clean water is placing increasing pressure on water supply, and climate change is expected to aggravate this challenge. Smart water management will be crucial in protecting the quality and consistency of the water supply, ensuring food security and encouraging sustainable

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agricultural development, hydropower generation, and other life-sustaining economic activity. The mismanagement of water resources can be more of a problem than water supply. Traditional water-management practices were based solely on mechanisms to control and monitor water supplies, reserves and quality. The water-management ecosystem from their potential sphere of impact and influence. As information and communication technologies (ICTs) began to play a greater role in water management, there was an assumption that the effectiveness and efficiency of water management would be guaranteed. This assumption did not hold true. “Smart” automation technologies or computerized systems cannot, in themselves, guarantee smart water management. These innovations are valuable components of the water-management process, but the collective benefits of these innovations are far greater if they are implemented and managed as part of an integrated, holistic system for smart water management. The challenge today is to enable the integration of traditionally independent components of water-management systems. The goal of smart water management is to provide a decision-making mechanism common to all stakeholders in water management, and ICTs should be viewed as the tools necessary to achieve this. Smart water management utilizes the knowledge and participation of all water-management stakeholders, as well as a variety of ICT resources and infrastructures, to build a water-management system that exploits aquatic ecosystems in a way that does not compromise social, economic or environmental sustainability. ICTs play a central role in smart water management by improving the efficiency with which water is distributed, managed and allocated. From the ICT viewpoint, smart water management can be seen as a set of technologies, services, infrastructures and communications that enable cohesion in all aspects of water management.

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