dialogues
Security

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OPEN-SOURCE DATABASES RELATED TO URBAN SECURITY ISSUES

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Abstract: Progressive urbanization of cities worldwide, appearance and expansion of so-called global cities (or world cities, megacities), global interconnectedness of large economic and trade urban centers, and rapid technological development of contemporary cities are just some of the most obvious advancements within global urban trends in the last decades. However, as urban history teaches us, with every new global development – from maritime economics and trade, colonization, and different industrial revolutions, through development of telecommunication, electric power transmission and tourism, all the way to environmental issues, globalization and the last ICT revolution – cities were the focus of some of the greatest pressures which appeared under these changes, primarily in the form of various population and infrastructure issues.

The immediate manifestations of these changes were mirrored in general population safety and security problems appearing constantly throughout history. As time went by, these urban security issues were addressed differently. In earlier stages of urban development, responses to security issues were mostly ad hoc, rarely institutionalized, based on simple solutions, and short-term oriented. With the advancement of urban infrastructure and management, these reactions became more complex, better informed and followed by long-term goals. Besides that, the diversity of stakeholders in this process developed as well. Today, there is a multitude of actors interested and involved in planning and executing various solutions for contemporary urban security issues. Traditionally, national and local government, are still key providers of security in this context, but often they are implementing solutions in partnership with international organizations, non-governmental organizations, civil society, private enterprises, the media, and academia.

The development of information and communication technology (ICT) in the last two decades brought some new possibilities for dealing with urban security challenges and threats, and the most important place in the development of these possibilities have the aforementioned non-state actors. New ICT environment brought up various and diverse means for automatization of collection, management, and use of important data regarding different urban security issues, for instance the traffic safety data, crime rates and distribution data, pollution data etc. These

aggregated datasets and data clusters, covering urban areas for decades back, today represent a precious resource for diagnosis of the existing urban security conditions, and also bear the potential for making precise estimations of trends regarding the concrete issue.

In this manner, the authors of this paper will try to make an overview of the most prominent existing databases regarding urban security, and discuss the need for open-source databases which are covering datasets related to urban security issues. This overview will also try to detect the urban security issues which are not addressed sufficiently and properly within these databases, and thus make the appropriate recommendations and directions for future developments in this field.

Keywords: open-source databases, urban security, big data, cities, information and communication technology (ICT)

Introduction

Progressive urbanization of cities worldwide, appearance and expansion of so-called global cities (or world cities, megacities), global interconnectedness of large economic and trade urban centers, and rapid technological development of contemporary cities are just some of the most obvious advancements within global urban trends in the last decades. However, as urban history teaches us, with every new global development – from maritime economics and trade, colonization, and different industrial revolutions, through development of telecommunication, electric power transmission and tourism, all the way to environmental issues, globalization and the last ICT revolution – cities were the focus of some of the greatest pressures which appeared under these changes, primarily in the form of various population and infrastructure issues.

Direct manifestations of these changes were mirrored in general population safety and security problems appearing constantly throughout history. As time went by, these urban security issues were addressed differently. In earlier stages of urban development, responses to security issues were mostly ad hoc, rarely institutionalized, based on simple solutions, and short-term oriented. With the advancement of urban infrastructure and management, these reactions became more complex, better informed and followed by long-term goals. Besides that, the diversity of stakeholders in this process developed as well. Today, there is a multitude of actors interested and involved in planning and executing various solutions for contemporary urban security issues. Traditionally, national and local government, are still key providers of security in this context, but often they are implementing solutions in partnership with international organizations, non-governmental organizations, civil society, private enterprises, the media, and academia.

The development of information and communication technology (ICT) in the last two decades brought some new possibilities for dealing with urban security challenges and threats, and the most important place in the development of these possibilities have the aforementioned non-state actors. New ICT environment brought up various and diverse means for automatization of collection, management, and use of important data regarding different urban security issues, for instance the traffic safety data, crime rates and distribution data, pollution data etc. Different state institutions, as well as private companies "release vast amounts of data at various spatial

and temporal scales" (Barthelemy, 2017:38). These aggregated datasets and data clusters – big data, covering urban areas for decades back, today represent a precious resource for diagnosis of the existing urban security conditions, and also bear the potential for making precise estimations of trends regarding the concrete issue. Briefly, big data is "enriching our experiences on how cities function, and it is offering many new opportunities for social interaction and more informed decision-making" (Batty, 2013:277).

In this manner, we will try to make an overview of the most prominent existing databases regarding urban security, and discuss the need for open-source databases which are covering datasets related to urban security issues. This overview will also try to detect the urban security issues which are not addressed sufficiently and properly within these databases, and thus make the appropriate recommendations and directions for future developments in this field.

ICT, data and databases for managing urban security

The digital revolution inevitably influenced the way we see and discuss about contemporary cities and its security. Information and communication technologies have been exerting a growing and pervasive influence on the nature, structure and enactment of urban infrastructure, management, economic activity and everyday life (Kitchin, 2014: 1). Shift toward information and communication technology (ICT) solutions that try to solve urban problems and provide services more efficiently over the past several decades are expressed in the idea of smart cities (Batty et al., 2012). This set of initiatives, strategies and approaches seek to transform urban governance, management and the way of living with the use of modern digital technology (Kitchin and Dodgge, 2017: 1). Smart city should be able to actively generate smart ideas in an open environment through fostering clusters or Open Data or developing proper living labs while directly involving citizens in the co-creation process of products or services. As a concept, it is described in various ways but a general definition involves implementation and deployment of information and communication technology infrastructures to support social and urban growth through improving the economy, citizens' involvement and governmental efficiency (Hollands, 2008). Through implementing information and communication technologies into municipal services, cities turn into being more intelligent in their management of resources (Bakıcı et al., 213: 137).

Smart city technologies are promoted as an advanced way to counter and manage urban insecurities and risks through the effective and efficient delivery of services (Paraušić, 2018). The smart city initiative fosters the idea that the best way to govern a city protects vital values, enable citizens satisfying level of wellbeing and participation is through technology, especially open and real time available data. Hence, the development and usage of databases in research and management of urban security is strongly in line with the idea of smart city.

Much detailed information about cities was available long before the advent of computing. Very large datasets, such as national censuses, government records and surveys that provide information about cities and their citizens have a long history. Data typically available included the overall population, its age and sex composition, educational level attained, household size, etc., on a local government level or even on a finer scale (Wang and Moriarty, 2018: 45). Ad-

ditionally, businesses and private companies have collated significant amounts of data about their operations, markets and customers. However, these datasets often rely on samples, are generated on a non-continuous basis, the number of variables is quite small, are aggregated to a relatively coarse spatial scale, and are often limited in access (Kitchin, 2014: 3). As a result, these large datasets have been complemented by individual research (questionnaire surveys, case studies, city audits, interviews and focus groups, and ethnographies) that capture a relatively limited sample of data that are tightly focused, time and space specific, restricted in scope and scale, and relatively expensive to generate and analyze, to provide additional depth and insight with respect to specific phenomena. Much of what we know about cities to date then has been gleaned from studies that are characterized by data scarcity (Miller 2010). Furthermore, traditional data collection could be costly, increasingly difficult, liable to error, and out-of-date.

Introducing big data and databases in research and practice on urban security gave hope to much more sophisticated, wider-scale, finer-grained, real time understanding and control of the city and urban life (Kitchin, 2014: 3). Some of these data are generated by local governments and state agencies, some by private companies, and some by non-governmental organizations and regional and international organizations. For urban managers these datasets provide abundant, systematic, dynamic, well-defined, resolute, relatively cheap data about city activities and processes, enabling the possibility of real-time analytics and adaptive forms of management and governance (Kloeckl et al. 2012).

Some known ways in which technology contributes to improvement of urban security include emergency telecommunication, surveillance and wireless video streaming, predictive policing with the help of ICT, social media monitoring etc. Many city governments now use real-time analytics to manage aspects of how a city functions and is regulated. For example, in transportation data from a network of cameras and transponders are fed back to a central control hub to monitor the flow of traffic and to adjust traffic light sequences and speed limits and to automatically administer penalties for traffic violations (Dodge and Kitchin 2007). Also, the police forces might monitor cameras and live follow incident in order to efficiently and timely direct resources to particular locations. Air and noise pollution, water levels and the like could also be followed by authorities, specialized agencies but also citizens.

Social media/networks have immense impact on nearly every sphere of modern life. The city is no exception; hence the urban environment presents itself with an unprecedented quantity of information in the form of items such as comments from Twitter and Facebook, reviews from TripAdvisor and pictures from Instagram and Flickr. As Ciuccarelli and associates notice: "By posting pictures, checking in at specific places, and sharing georeferenced content as part of their everyday experiences, people are—more and more—making information available on how they live in, use, and perceive urban spaces (Ciuccarelli et al., 2014: 5). Collecting, analyzing and presenting time-based geo-located social media data on urban life represent new way to visualize urban life and events and problems in urban areas. Conceptualizing this type of database could be significant source of knowledge for urban security provision and management and dealing with security threats.

Promoting the citizens` participation, there is growing number of applications available that could be helpful in citizen reporting, social platforms to discuss security problems in the city, emergency applications for alerting family and friends (Habeeb Rahman, 2013). These platforms function as databases of events people report almost every day, and refer to such urban security threats as sexual violence and harassment, crime, vandalism, bad traffic or some signs of physical or social disorder (Paraušić, 2018). They represent unique set of human experience and potentially have great academic and practical value. The idea with these platforms is to make the data useful for individuals, local communities and local administration to identify factors that cause behavior that leads to violence and work on strategies for solutions. The great advantage is the availability of the data, where interested persons (officials, researchers, citizens) could have real time information about what is happening in their city.

Also, in line with participatory approach is an initiative to introduce interactive dashboards, the data shared with citizens through online, interactive data visualizations. Dashboards provide a means of collecting together and displaying a number of indicators through a common graphic interface (Lake, 2013). These dashboards graph and map indicator data, providing detailed information about city performance and trends, without citizens needing to learn how to handle data or use specialist visualization software (Kitchin et al. 2015: 7).

As we may conclude, technology, data and databases have major impact on how we perceive, understand and govern the contemporary city. Factual data can be statistically analyzed and visualized to reveal patterns and trends about urban security related issues. They provide basis for monitoring and evaluating the effectiveness of urban polices and measures and to develop new interventions. Existing databases represent desirable resource in explaining and understanding urban security, and research based on these data provide results that are equally usable both for responding and for dealing with security challenges (Dimitrijević and Paraušić, 2017: 12). Consequently, the open data is not just changing the way urban security is studied, but also the relations between government and the public, the urban security provision and management. Presenting in detail all the ICT solutions for addressing and tacking urban security problems goes beyond the objectives of this paper. Therefore, some of the most prominent existing databases regarding urban security are presented and discussed in the next section.

Overview of Open-Source Databases Related to Urban Security Issues

What are the main primary sources for open-source databases and repositories of data related to urban security? Firstly, much of the used and freely available data comes with the Open Data movement or idea. Although it is vast and all-present, Open Data related to urban issues could be put into a subcategory of Open Government data. In this context, "open data can be powerful force for public accountability – it can make existing information easier to analyze, process, and combine than ever before, allowing a new level of public scrutiny" (Yu & Robinson, 2011:182). Many governments around the world have Open Data portals available for public use, and the number of cities worldwide providing free urban data is growing daily. That is why many existing databases related to urban issues use these data as their primary sources.

The other large pool of data for aggregated global urban databases are social networks. Their importance at the beginning of the 21st century is essential for various aspects of social life, and the added value of social networks are automated big data practically ready to be used in complex research. Today, there are 4,4 billion internet users, around 3,5 billion active social media users, with around 3,4 billion of them using mobile social media (Datareportal, April 2019), which represents and unprecedented source of both quantitative and qualitative data. Social networks also provide the possibilities for crowdsourcing.

In this chapter, we will provide an overview of databases that use urban data from major world cities and thus have a global scope and could be used for various comparative research in different security-related issues.

UN-Habitat Urban Data

One of the most comprehensive databases on urban data is certainly the UN-Habitat's Urban Data, which contains "urban indicators data" that is "analyzed, compiled and published by UN-Habitat's Global Urban Observatory" (UN-Habitat, 2019). Its global reach is based on the system of collecting the data from all the UN member states, and at the moment it covers 220 states and territories, 741 cities, and 103 indicators: "Urban statistics are collected through household surveys and censuses conducted by national statistics authorities. Global Urban Observatory team analyses and compiles urban indicators statistics from surveys and censuses. Additionally, Local urban observatories collect, compile and analyze urban data for national policy development. Population statistics are produced by the United Nations Department of Economic and Social Affairs, World Urbanization Prospects" (UN-Habitat, 2019).

World Urban Database and Access Portal Tools (WUDAPT)

World Urban Database and Access Portal Tools (WUDAPT) presents an "international community-based initiative to acquire and disseminate climate relevant data on the physical geographies of cities for modeling and analyses purposes" (Ching et al, 2018). It has a database which is structured within hierarchy that present different levels of detail, for which the data is collected through "crowdsourcing, Geowiki tools, freely accessible data, and building typology archetypes" (Ching et al, 2018). The idea behind the project is "to acquire and store urban data using a common framework and to link these data to available methods for climate analysis and for current and what-if scenario development" (WUDAPT, 2017:3).

WUDAPT provides three-level products, Level 0, Level 1, and Level 2, depending on details. The lowest level of detail (L0) is transforming urban landscapes into the Local Climate Zone (LCZ) through local expertise, Landsat remote sensing data and software. Within WUDAPT database, L0 data cover something over 120 city regions around the world. It could be used for weather research and forecast modelling, and by anyone interested.

Level 1 is more detailed and could be used for weather and climate, urban air flows, urban radiation, mean radiant temperature, urban energy consumption, air pollution, $CO2$ and GHG emission, biodiversity, urban master plan, land use plan, green master plan, new town plan etc. Also, the scope of potential users is larger - environment scientists, climatologists, meteorolo-

gists, engineering consultant companies and design firms, education institutions, NGOs, urban designers, town planners, city government planning departments, transportation offices, public works departments, zoning boards etc. (WUDAPT, 2017:5).

Level 2 data cover complete urban landscape with additional information on individual urban elements like buildings, streets, parks etc. The information covered by the L2 data could have added value with information on the types and structure of buildings and other individual elements, which could be acquired through remote sensing. More details and properties could be provided through Open Data such as census data, and through crowdsourcing as well (WUDAPT, 2017:6). The visualization of L2 data is given in Figure 1 below.

Figure 1. WUDAPT Level 2 product (3D morphological data of Kowloon Peninsula, Hong Kong)
(Source: WUDAPT, 2017:7, http://www.wudapt.org/wp-content/uploads/2017/06/WUDAPT-Briefing-Doc_20170630.pdf)

Urban Data Platform

The Urban Data Platform represents a "joint initiative of the Joint Research Centre (JRC) and the Directorate General for Regional and Urban Policy (DG REGIO) of the European Commission. It is a key component of the Knowledge Centre for Territorial Policies and aims at providing access to information on the status and trends of **European cities** and **regions**, as well as to the exploration of EU supported integrated urban and territorial development strategies" (European Commission, 2019). It has several features related to urban data for European Union member countries.

The first and main feature is the Urban and Territorial Dashboard platform, which provides up-to-date data on cities and functional urban areas for the following categories: population dynamics, health, transport and accessibility, environment and climate, urban development, security and safety, and social issues. The following feature are Trends, which visualizes population trends in the EU cities, and gives an overview with a possibility of comparing different cities. The feature Thematic Analyses provides reports with in-depth analyses regarding different indicators.

Urban Data Platform also provides two tools for urban data. The first one, STRAT-Board, gives an insight into the integrated approach to urban and territorial development as supported by EU provisions and tools. The other one is the NUTS Converter, which provides a conversion of European regional statistical data between different versions of Nomenclature of Territorial Units for Statistics classification (European Commission, 2019).

UrbanData2Decide (UD2D)

One of the upcoming portals for urban big data is UrbanData2Decide project, which was created in 2014 by consortium of Vienna Company SYNYO, University of Oxford, Malmö University, The Open Data Institute, IT University of Copenhagen, Centre for Social Innovation from Austria, and many European city partners. The project's aim is to "extract and process information from two rich sources, namely public social media and open data catalogue" (UD2D, 2019). The data collected is then visualized, supported with the experts' advice, and made ready for local governments and their decision-making process, so they could tackle issues like urban safety and urban security.

The motive behind the UD2D was the fact that urban governing officials confront various challenges on everyday basis, and have to react to them in timely manner with critical decisions to make in that process. Based on that, the idea was simple – to provide these urban decision-makers with their own Open Data boosted with additional data like citizen-generated content (crowdsourcing from social networks), and various Open Data catalogues, repositories, hubs, platforms etc.

For effective use of data collected, the consortium developed two systems of their own – UrbanDataVisualiser and UrbanDecisionMaker. The first one, UrbanDataVisualiser "aggregates, structures and visualize data using a multi-layered and multi-dimensional approach" (UD2D, 2019). After that, "the framework uses data mining, sentiment analysis and visualization techniques… to develop a proof-of-concept demonstrator to showcase the information using intuitive and clear dashboards" (UD2D, 2019). UrbanDecisionMaker, on the other hand, "will complement this bottom-up approach by integrating external experts and advisors using scientific multi-round expert integration methods and tools like Delphi method, a structured communication technique, developed as a systematic, interactive forecasting method which relies on a panel of experts" (UD2D, 2019). The complete concept of the project is visualized in Figure 2 below.
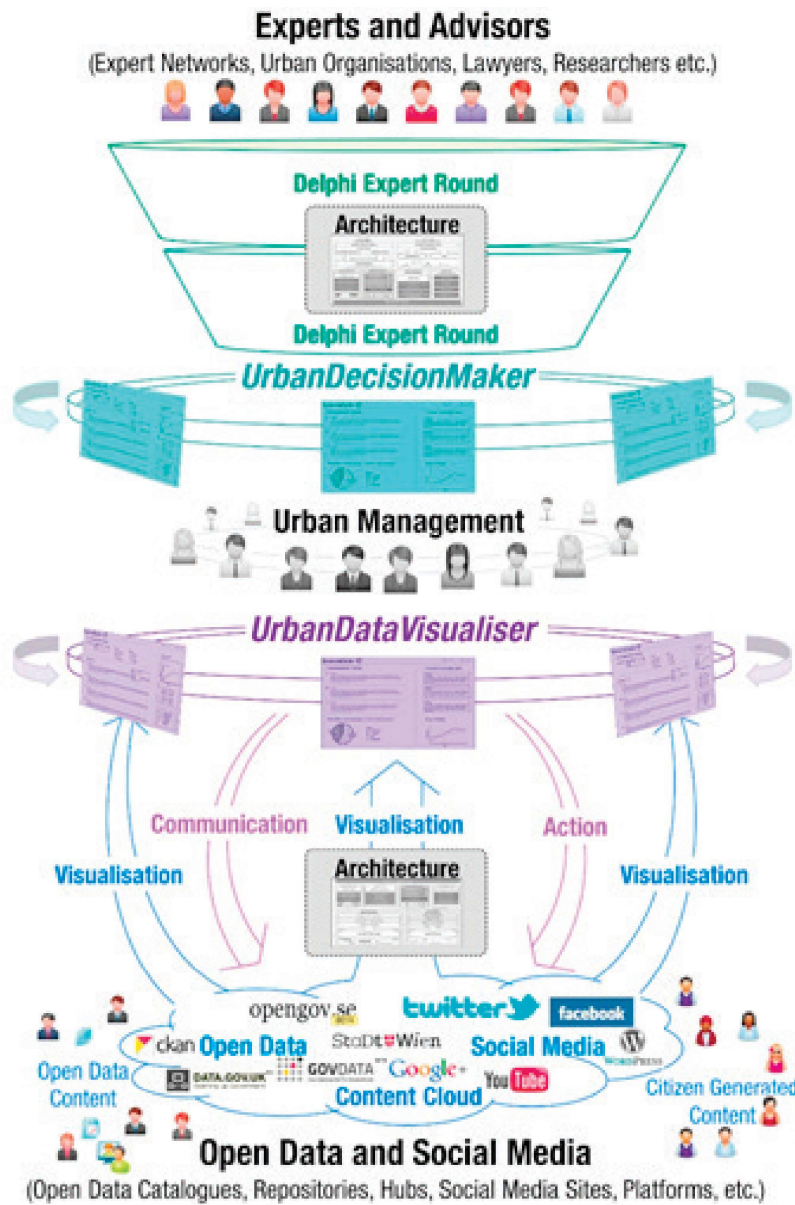
Figure 2. UrbanData2Decide concept explained
(Source: http://www.urbandata2decide.eu/project-overview/, accessed on May 15th, 2019)

Conclusion

Today, a lot of urban open-source information is available through digitalization of cities themselves, which can be a pool for abstracting information and analyzing it for better understanding and improving contemporary urban life. It means that people living in cities "can now provide local knowledge through a bottom-up approach, contributing information through the use of widely diffused technologies", e.g. by "posting pictures, checking in at specific places,

and sharing georeferenced content as part of their everyday experiences, people are—more and more—making information available on how they live in, use, and perceive urban spaces" (Ciuc-carelli et al, 2014:5). Accordingly, there are numerous tools for obtaining and analyzing these vast data in practically real time.

ICT solutions and databases for securing the city are beneficial in many ways for providers and researcher alike. Real time city data analytics, databases, apps and dashboards provide a powerful means for making sense of, managing and living in the city and for predicting future scenarios. Rather than basing decisions on intuition or clientelist politics or periodic/partial evidence, it is possible to assess what is happening at any time and to react and plan appropriately (Kitchin, 2014: 7). Moreover, usage of reliable, easily available and timely data provides a deeper, more holistic and robust analysis.

Databases presented are only those with the biggest scope and from prominent sources, but it should be mentioned that there are plenty of local government databases, local initiative projects and private databases related to local and regional levels of analysis of urban data. Databases of bigger scope are useful for plethora of potential research in context of global trends, for example pollution or crime rates caused by rapid urbanization. However, local or regional databases are useful as well, especially when supported with data from big databases. In that manner, these databases could be used for determination of safe and unsafe locations in the city, for geolocating the risk areas cross-referenced with data about the nearest police stations or health services, etc. For instance, big data could help in dealing with emergencies and urban crises in real time through using real-time social networks data like photographs for augmenting "remote sensing observations of transportation infrastructure conditions in response to emergencies" (Thakuriah et al, 2018:6). Also, big data could help in monitoring structural health of buildings, waste management, traffic congestion, urban energy consumption, urban health and well-being etc. (Wang & Moriarty, 2018), and could be used by local governments for designing the safe and secure city parameter measurement procedures (Setiyono & Supangkat, 2018).

For modern urban management, it is of utmost importance to bear in mind two substantial facts – "data is essential for evidence-based policymaking and effective investment in and management of infrastructure in a city" and that "comparative analysis and knowledge sharing is crucial to respond to emerging global challenges the associated demand for sustainability planning, resilience and emergency preparedness" (UN-HABITAT, 2016:43). In the intersection of these two facts, the internet with its timely data availability about modern urban issues is located, and should be used extensively for dealing with all the urban challenges of today.

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