

DATA ANALYTICS USING AOT: A SURVEY

Kritika Vohra, SriHarsha Marella, Anushka Dhar, Ashwin Deshpande

JSPM's RSCOE, S.P. PUNE UNIVERSITY, PUNE, INDIA

Abstract - Smart City is adopted by many governments to implement sustainable solutions and improve the quality of life of the people. It tells how big data can be used for smart city solutions, and provide a process flow, mapping for some of the smart city components. Also as the smart city involves the factor of environmental conditions, main aim is to study and develop the technologies and solutions for implementation, deployment of advanced information services for citizens and visitors based on technologies such as Open Data. Mobile Crowd sensing (MCS) management for environmental data, information representation and unification, IoT service composition and deployment is used. The sensors are monitored over a time and the analysis is done and being represented in a webpage. Thus, this will help make city a smart city.

Key Words: Smart city; Big data, technology, components.

1. INTRODUCTION

As, we know the world is growing rapidly. Various new emerging technologies are coming into existence. Amongst that one is AOT which is basically known as 'Array of Things', which is basically an urban sensing project to collect real time data. The initiative was first taken by Chicago with the mission of developing smart city that will be healthier, efficient and livable. The usage of various sensors like temperature, water, smoke and noise will collect the data from various locations and that data will be transmitted to a secure database. After analysis of data collected, the AOT will be used to monitor the city's environment and activity. Sensors monitoring can suggest the healthiest and unhealthiest walking times and routes through the city.

Measurements of micro-climate in different areas of the city will help the residents to get up-to-date information of weather.

All the data being collected from AOT will be regularly reviewed will be open, free and available to public and will then be published openly to allow individuals, organizations, researchers to study urban environments, develop new data analysis tools and applications.

1. WHAT IS SMART CITY ?

A Smart City is an urban innovation aimed to improve the quality of life of its citizens. A smart city employs technology to bring about development on social and economic front.

Different definitions have been formulated for smart city. Some of them are described below:

A. Definitions

Gartner [2] defines smart city as an urbanized area where multiple sectors cooperate to achieve sustainable outcomes. This is done through the analysis of contextual and real-time information.

According to IEEE [3], a smart city brings together government, society and technology to enable smart economy, smart mobility, smart environment, smart governance and overall smart living.

IBM [4] defines a smart city as being instrumented, interconnected and intelligent. This is achieved by connecting the physical, social, business and IT infrastructure in order to leverage the collective intelligence of the city.

According to our Indian Government [1], the picture of a smart city contains a wish list of infrastructure and services that describes the level of aspiration of an Indian citizen. The urban eco-system can be represented by four pillars of development - on institutional, social, physical and economic front.

One of the definitions listed by Chourabi et. al.[5] describes smart city as - a city combining ICT and Web 2.0 technology with other organizational, design and planning efforts to identify new, innovative solutions in order to improve sustainability and livability.

2. DATAFICATION OF SMART CITIES

Where there is technology, there is data! Data is generated on every aspect of our life. Our daily conversation in the form of telephone calls and emails is digitalized and stored. Our web activities, be it reading, searching or paying bills – are stored in the form of log data. CCTV footage captured at the entrance of smart buildings; images and videos captured on smart phones; and our daily routine captured by wearable devices is also stored in digital form. Indeed, smart cities concept is about capturing, processing, storing, analyzing and sharing large amount of data related to infrastructure, services and citizens.

In other words, it is about making the city data-driven. In this section we attempt to give a comprehensive list of all sources which can generate data in the urban space,

2.1 Challenges and Issues of Smart City Data

- Smart city data faces multiple challenges due to its volume, velocity and variety. The data is unstructured because it may be in the form of audio, images, log files,

tweets, text, etc. It has to be integrated with structured data from different ERP systems.

- The sources of data could be legacy sources, new technology sources, IoT devices or manual entry done by human beings.
- The IoT sensors may not be working at some places, giving faulty or missing data. Human entry may result in mistakes which need to be rectified. Thus, lot of pre processing needs to be done on such data. As a result, smart city data becomes Big Data when it comes to technology.
- Therefore, it poses all those challenges which big data has, related to capturing, storing, searching, sharing, analyzing and visualizing. In addition, it faces challenges related to security and privacy as well.

3. LITERATURE REVIEW ON BIG DATA FOR SMART CITIES

Big Data and Analytics is a very wide research area. Lot of companies are adopting big data solutions for their business. It is not surprising, therefore, that big data solution has been proposed for Smart Cities concept as well, in many of the literature works. Companies like IBM and CISCO have already launched smart city platforms over big data framework [8].

In [8], the authors have shown how big data is a promising field to exploit smart city solutions. Big data provides support for storage and analysis of heterogeneous data generated by a city.

In their work [9], the authors have highlighted the contributions from research areas towards smart city projects. The areas selected are crowd management, tourism, digitization and application of big data analytics.

In [10], the authors have highlighted the benefits of big data for smart city, namely monitoring, management and optimization of real time systems. In their work, they have analyzed the correlation between traffic, temperature, season and working day, using Smart Santander test bed and big data analytics tool.

In [7], the authors have discussed the challenges and opportunities of using big data applications for smart cities.

In [6], the authors have proposed a general framework for urban computing using big data. This framework can be used to ease traffic congestion, save energy and reduce air pollution using geographical, sensor and mobile data. The authors have used spatiotemporal indexes and classifiers on big data for the above applications.

In [11], the authors have discussed cloud based big data analytics for smart cities. They have developed a prototype using MapReduce to demonstrate how cloud infrastructure can be used, by taking a sample set of Bristol open data. By comparing Hadoop and Spark, they have inferred that Spark

is more suitable for analysis of the given dataset. Bao, Zheng and Mokbel have presented a location based and preference aware recommender system in their paper [12],

Using candidate selection algorithm. Zheng et. al. have developed a predictive model which is data driven and can forecast fine-grained air quality using big data. The model handles spatial correlation of air quality among different locations. More details can be found in their work [13].

In [14], the authors present a framework for intelligent processing of textual streams coming from social networks.

This framework has been used to monitor the recovering state of a city after an earthquake by doing sentiment analysis.

In [15], the authors have proposed a combined IoT based system for urban planning using big data analytics. The 4 tier architecture suggested by them includes Hadoop framework with Spark as well as Storm tools. They have taken datasets related to floods, temperatures, pollution, parking, weather and social media for analysis.

Last, but not the least, the authors of [16] have done a comprehensive review of big data literature to identify challenges, areas of application, tools and emergent trends of big data. They have analyzed 457 papers related to big data. They feel that it is necessary to develop tools and abilities to extract value from big data in the context of smart cities.

3. CONCLUSIONS

This review paper provides information about the ways to make city a smart city. It discusses the use of various sensors such as air, water, noise and smoke and it provides the data through the sensors. Analysis of data is done based on that data.

REFERENCES

- [1] Government of India, "Smart Cities Mission," <http://smartcities.gov.in/>
- [2] Gartner, "Gartner Says Smart Cities Will Use 1.6 Billion Connected Things in 2016", <http://www.gartner.com/newsroom/id/3175418>
- [3] IEEE, "IEEE Smart Cities", <http://smartcities.ieee.org/about>
- [4] Harrison et. al., "Foundation for smarter cities", IBM Journal of Research and Development (volume 54, issue 4), 2010
- [5] Chourabi et. al., "Understanding Smart Cities: An Integrative Framework," IEEE 45th Hawaii International Conference on System Sciences, 2012
- [6] Zheng, Capra, Wolfson, Yang, "Urban Computing: Concepts, Methodologies, and Applications", ACM

Transactions on Intelligent Systems and Technology, Vol. 5, No. 3, Article 38, September 2014

[7] Nuaimi, Neyadi, Mohamed, Jameela, "Applications of big data to smart cities", Journal of Internet Services and Applications - a SpringerOpen Journal, 2015

[8] Vilajosana et. al., "Bootstrapping Smart Cities through a Self-Sustainable Model Based on Big Data Flows", IEEE Communications Magazine, June 2013

[9] Curry, Dustdar, Sheng, Sheth, "Smart cities – enabling services and applications", Journal of Internet Services and Applications, 2016

[10] Jara, Genoud, Bocchi, "Big Data in Smart Cities: From Poisson to Human Dynamics", IEEE 28th International Conference on Advanced Information Networking and Applications Workshops, 2014

[11] Khan et. al., "Towards cloud based big data analytics for smart future cities", Springer Open Journal of Cloud Computing, 2015

[12] Bao, Zheng, Mokbel, "Location-based and Preference-Aware Recommendation Using Sparse Geo-Social Networking Data", ACM SIGSPATIAL GIS'12 November 6-9, 2012

[13] Zheng et. al., "Forecasting fine-grained air quality based on big data", ACM KDD, 2015

[14] Musto, Semeraro, Marco de Gemmis, Lops, "Developing Smart Cities Services through Semantic Analysis of Social Streams", ACM WWW 2015 Companion, Italy, May 18–22, 2015

[15] Rathore, Ahmad, Paul, Rho, " Urban planning and building smart cities based on the Internet of Things using Big Data analytics", Computer Networks, Elsevier, 2016

[16] Mazahua, "A general perspective of Big Data: applications, tools, challenges and trends", Springer, 2015

[22] Punde S. S. ,Khandelwal C. S., Jain A.S. &Sapkale G.B. "Content based sensor data retrieval using ZIGBEE",e-ISSN: 2278-2834, p-ISSN: 2278-8735.

[23] MatteoNardello, Maurizio Rossi and DavideBrunelli "A Low-cost Smart Sensor for Non Intrusive Load Monitoring Applications",978-1-5090-14125/17/\$31.002017IEEE.

[24] AartiRaoJaladi, KarishmaKhithani, PankajaPawar, KiranMalvi, GauriSahoo "Environment Monitoring Using Wireless Sensor Networks(WSN)",ISO 9001:2008 Certified Journal.

[25] BaccoManlio, Delmastro Franca, Ferro Erina, Gotta Alberto "Environmental Monitoring for Smart Cities"1558-1748 (c) 2017 IEEE.

[26] Alfonso Quarati, Andrea Clematis, Luca Roverelli, Gabriele Zereik, Daniele D'Agostino,"Integrating Heterogeneous Weather-Sensors Data Into a Smart-City App"978-1-5386-3250-5/17 \$31.00 © 2017 IEEE