

# **EXERCÍCIO 3 – REFERENCIAL TEÓRICO**

**ENGENHARIA DE REQUISITOS  
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## **First paper: Collective Citizens' Behavior Modelling with Support of the Internet of Things and Big Data**

This article talks about how can the Internet of Things provide Big Data about human behavior in general. The main goal of the research is analyze how the computer technology, especially the IoT and big data, can improve the information system effectiveness of smarty city.

As methodology, it analyses how can Twitter's citizens blog complements the IoT, since it allows the society to be interconnected. But, the main goal of the article is to elucidate some of the main concepts that allow us to collect data on our society: first characterizing IoT, then MapReduce and its uses for Big Data and IoT. It then talks about Intelligent Agents for IoT implementation in our society, and how can they improve the reliability for IoT, since it is one of its main problems. Then it goes describing genetic programming and Artificial Neural Networks in Data Mining for IoT.

The article does not have a real conclusion – its main goal was elucidate some concepts that can be used in collection human behavior data. I really enjoyed reading it, since it showed me how many concepts that were still lacking in my head can be used to improve the concept of smart cities, and also introducing to some research areas that still have many issues to solve, such as efficient use of IoT in transportation.

Its main conclusion is that, with the IoT and cloud computing evolving more and being more integrated to the society, it will be possible to provide big data about human behaviors, which then can be used to prevent crisis situation or to prepare annual expenditure budget to satisfy a community expectation (Balicki et al., 2015).

## **Second paper: Smartbuddy: Defining Human Behaviors Using Big Data Analytics in Social Internet of Things**

This article main focus is how can the smartphones, smartcities and social networks work together with the Internet of Things can be used to describe human behavior in the social area in real time, the main goal of the research. It presents a new concept (SmartBuddy) that focus on analysis, the ecosystem provided by smart cities, wearable devices, as well big data to determine human dynamics.

To analyze the data, the article used four different datasets, each one to a different purpose, and the developed system, SmartBuddy, is used to give the main takeaways from the data analysis.

The conclusion of the article is that, instead of focusing on the data and its insights, the correlation among different attributes of data and facilitates the understanding and definition of human behavior, while also implementing the concept of SmartBuddy that provides instant feedback to users to offer them the chance to improve their behavior (Weinberger, 2013).

### **Third paper: Internet of Things and Big Data Analytics for Smart and Connected Communities**

This article introduces a new concept: Smart and Connected Communities (SCC). It is composed by the Internet of Things, that has potential to provide a ubiquitous network of connected devices and smart sensors, and the big data analysis, that can allow the move from IoT to SCC, which has the goal to improve livability, preservation, revitalization, and attainability of a community (Sun, Song, Jara, & Bie, 2016).

When we say such concepts as livability, preservation, etc, it is hard so visualize them without a formal definition, which the article provides. This taught me on how we need to conceptualize this kind of things, as you told me in the last class.

The article goes on explaining the main opportunities on IoT and Big Data Analysis in SCC, and then providing a use case using both this technologies: TreSight, responsible for smart tourism and sustainable culture heritage in the city of Trento, Italy.

The article is then concludes the conception of SCC, an evolution to smart cities, which main goals are live in the present, plan for the future and remember the past, so while it does not solve any problems, it does introduce a new concept and potential research areas in both IoT and BDD.

### **Forth paper: Integrating Physical and Social Sensing to Enable Smart City Mobility Services**

This article introduces on how can physical sensing, usually led by *wireless sensor networks*, which is in a constant evolution, and social sensing, can improve how the world is connected by us, introducing the concept of smart sustainable city, which is illustrated by the building in Amstardam, Edge. It relies on 28 thousands of sensors and instruments, to allow smart services for the entire building, such as where you live, what car do you drive, where is the optimal place for your desk, your schedule, etc.

The paper then goes on studing how integration physical and social sensing can help enable smart services in the context of smart cities, focusing on people's mobility management, make cities smarter and more sustainable .

It then goes on exploring how can big data can further enhance smart services and introduce a smart city big data platform, then showing a case study in the end, the Open-data platform of the City of Lyon, France.

The article is then concluded, presenting us on how can we explore a framework to integrate both physical and social sensing to further enhance and empower system in general. With the growing world population, we need innovative approaches to improving and maintaining sustainable city public infrastructure (Qiu, Qiu, Badr, & Division, 2016).

Finally, it presents new area that the authors will be focusing on the future, as well as them being new concepts that can be further researched: develop crowd sensing or social sensing based platforms, specifically, enhance the on-going research by taking into consideration new variables: city events, weather and time, in order to improve the future smart city service.

### **Fifth article: Towards an IoT Big Data Analytics Framework: Smart Buildings Systems**

This article focus is the challenge of real time analytics of the large amount of high speed data generated from the smart building IoT devices, providing an integrated framework of IoT Big Data Analytics (ITBDA). It is evaluated by using it to monitor and control oxygen level, luminosity and smoke/hazardous gases of the smart building to improve user experience, comfortability, safety and health.

The first article I read with a clear goal! The paper's objective is to develop and evaluate the IBDA framework for real time data management and analytics for the generated data from IoT sensors, also using a design research approach. In this kind of approach, a framework is developed and evaluated in the world, solving real problems.

The languages and technologies being used in the framework are described next, and then explaining how it would work. Using PySpark, it would analyze the fetched data from the building, and see if the oxygen level is appropriate, and act accordingly.

The papers clearly explain how is the process being made: the data generation, data extraction, ingestion, visualization, analytics, and finally, the control of the smart building, which was a change from the previous article. I really liked reading through this paper, because it was somewhat different from the previous articles, which focused on a more explanatory and descriptive approach, which I was really fond of.

The main result was on how the IBDA framework can improve the smart buildings service. It demonstrated how smart buildings components such as oxygen pumps, fire alarms and lights can be controlled automatically without human intervention, and proving it first hand. Finally, it concluded on how it can be further researched by looking into applications besides smart buildings, such as cities and airplanes, in order to keep control of the oxygen level to improve comfortability, health and safety.

## **Conclusion:**

After reading this articles, I got a better sense on research paper's structure, and why does it work like this, which was pretty well timed, after our class about literature review.

Only the last article solved a real problem, and the others focused on introducing new concepts and research areas. I found this to be very enlightening – after reading the four, the last showed me how different the general model of the article can be, given its focus.

This research area of smart cities is really amazing me. It seems there's infinite possibilities, and that's certainly a challenge for me in this, since we need to focus on a lower level problem/question. But, after reading this four articles, I got a lot more sense on Big Data Analytics and IoT, and how they can work with each other. One area that I particularly showed interest, that I read in the first article is how can IoT and BDA work to improve city transportation (Balicki et al., 2015). It is cited in the article as something that can be further researched – how can we the big data provided by humans to improve traffic, for instance? Google Maps and Waze are really changing how the traffic work, and I think it could be further enhanced by using IoT and BDA. For instance: if we could ready the data from Tweets, which people are sending to inform each other about a situation in traffic, in order to determine the best route this kind of scenario. Or, taking into city events, weather and time, in order to improve the future smart city service (Qiu, Qiu, Badr, & Division, 2016) and general mobility.

Overall, after reading those papers, I feel a little bit more focused on this really big theme: smart cities. And, for my next work, I will probably research more on this specific subject: how can IoT and BDA improve city traffic and people mobility.