

Chapter 62

On Internet of Things and Big Data in University Courses

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ABSTRACT

In this paper, the authors discuss Internet of Things educational programs for universities. The authors' final goal is to provide a structure for a new educational course for Internet of Things and related areas such as Machine to Machine communications and Smart Cities. The Internet of Things skills are in high demands nowadays and, of course, Internet of Things models, as well as appropriate Big Data proceedings elements should have a place in the university courses. The purpose of the proposed educational course is to cover information and communication technologies used in Internet of Things systems and related areas, such as Smart Cities. The educational course proposed in this paper aims to introduce students to modern information and communication technologies and create the formation of competencies needed for such areas as Machine to Machine communications, Internet of Things, and Smart Cities. Also, the authors discuss Big Data issues for IoT course and explain the importance of data engineering.

1. INTRODUCTION

This paper contains an extended and redeveloped version of our presentation for the 20th Conference of Open Innovations Association FRUCT and ISPIT 2017 seminar (Namiot, Sneps-Sneppe, & Daradkeh, 2017). It continues our series of articles devoted to computer science and Internet of Things (IoT) education (Namiot, 2016).

Currently, the issues related to the Internet of Things and Machine to Machine communications (M2M) are attracting a lot of attention and IoT (M2M) skills are in high demand. In the same time, many existing presentations of IoT applications and systems contain only futuristic descriptions. They are more concentrated on the public effects and their impact on an everyday life. So, the technical things are completely missed. However, all the above-mentioned acronyms (IoT, M2M) have nowadays a full

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line of standards, frameworks, development tools etc. In our opinion, it is very important to study the technical aspects of IoT (M2M). By 2020, the global demand for IoT developers is estimated at 4.5 million people (Asay, 2014). This demand naturally raises the questions of deep learning for IoT technologies.

Currently, we cannot mention a single course on the Internet of Things covered all the aspects. Actually, there are no even unified approaches to its content and structure. Naturally, both of these technologies – IoT and M2M (or more accurately - both of these directions) did not arise in a vacuum, they are not administered (at least in large numbers) of their own areas in the disciplines related to information and computer technology (Computer Science).

However, of course, we can talk about the development of specific programming architectures and models for IoT (M2M), etc. For example, some of the top-level models for IoT and M2M programming models have been published in our papers (Namiot & Sneps-Sneppe, 2014a; Namiot & Sneps-Sneppe, 2014b). It seems that, at least, the navigation tool for the audience (students) in the current situation in IoT (M2M) could be very useful. In our opinion, the understanding of the architectures is a key moment for development.

In the current state of our project, we are talking about a semi-annual course which aims to introduce students to modern information technology, standing for such areas as the M2M and IoT. In this case, it refers to students studying in areas related to Computer Science. In our practice in Russia, for example, such a course could be a part of master's program in Faculty of Computational Mathematics and Cybernetic Lomonosov Moscow State University. Ventspils University College looks for some post-graduate education.

The big question here is debatable - it is necessary or not to include here the materials for the Smart City. Very often, it is considered in conjunction with IoT, for example. In our vision, at least for now, we should not include Smart City related questions into IoT courses. Firstly, in many aspects, it seems still more related to the processes of the organization, rather than information technologies. In the same time, our idea was to stay in computer science and computer engineering domains, which include precisely IoT and M2M. In general, Smart Cities themes should be closer to the general sections of the digital economy. On the other hand, the borders are often blurred. For example, we can mention here such a popular direction as cyber-physical systems (Baheti & Gill, 2011). As per definition, they are engineering systems based on the interaction of software algorithms and physical objects. Cyber-physical systems (CPS) are integrations of computation and physical processes.

In summary, the questions for research can be formulated as follows. What exactly and why should be included in the course (or courses) of master's level training on the topic of Internet of Things?

The rest of the paper is organized as follows. In Section 2, we discuss the general content for IoT courses. This section is updated from the conferences feedback and suggestions from reviewers. In Section 3, we provide an overview of existing courses. This section is also updated mainly from the conferences feedback. In Section 4, we describe our IoT course content and proposals.

2. WHAT TO LEARN IN IOT COURSES

In this section, we would like to discuss the common content for IoT educational programs. According to (Holdowsky, Mahto, Raynor, & Cotteleer, 2015; Rose, 2014), IoT directions could be grouped into five topics:

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