Chapter 51
The Human–IoT Ecosystem: An Approach to Functional Situation Context Classification

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ABSTRACT

IoT devices offer a cheap and powerful approach to identifying real world states and situations and acting on this real world environment to change these states and the environment. Augmenting real world things with IoT technology enables the capture of real world context to support decision making and actions in the real world via powerful smart objects in a human- IoT ecosystem. Increasingly we will have to understand the Human-IoT or smart device ecosystem interaction in order to optimise and integrate the design of human and IoT systems. This chapter explores the design and categorisation of IoT devices in terms of their functionality and capability to support context to add to human perception. It then proposes how we can model the context information of both IoT devices and humans in a way that may help progress Human-IoT Ecosystem design using situation theory.

INTRODUCTION

Layout of the Chapter

This chapter focuses on IoT sensor functionality and an approach to context modelling that is applicable to both IoT sensors and humans, both of which have to make decisions based on 'context'

We firstly introduce the key IoT context issues to be addressed and describe what constitutes an IoT thing and a model of the basic IoT components. Section 2 develops a functional model to classify IoT devices based on descriptive ontology and explores categorisations of IOT devices in terms of these functions, Section 3 explores smart IOT and context aware objects. Section 4 then applies the basic

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premises of situation theory to defining the parameters that relate to context to further define the specific capabilities of IoT devices and model specific examples from the literature. Section 4 discusses an integrated approach to analysing Human-IoT task situations using the model to identify IoT design possibilities. Section 5 then discusses the benefits and summarises the work.

What Is IoT?

IoT objects are everyday objects augmented with sensors and processers and a set of rules to gather data and in some cases interpret and make intelligent decisions (Santos et al., 2014). IoT devices have a digital identity and are ubiquitously interconnected on a network and to the global Internet. This capability enables everyday objects to be augmented with the ability to sense and act on the environment. Rule based processing in the device or information from the device processed in networked applications or middleware enables a range of 'intelligence', the ability to make rule based changes and the ability to interpret and react to their environment (Michell, 2014) These devices can communicate over short 'near field' distances e.g., between sensors and the device using radio frequency links. But a key enabler if IoT objects is their ability to communicate to the web and hence an almost infinite number of other devices and humans and hence application uses (Sundmaeker, 2010). As Miorandi et al. (2012) assert, IoT is a generic term for systems that have embedded identification, sensing and actuation i.e., movement ability distributed spatially and their links to the web with a massive range of user applications. Adding IoT functionality to everyday objects endows that object with 'intelligence' via application logic to make sense of environmental data and global communications options via the web (Kortuem et al., 2010). Things refers to both 'real and virtual entities that are capable of being identified' (de Saint-Exupery, 2009) and used in the human environment. Miorandi et al. (2012) describes "things" as information entities that have:

- Physical existence,
- Communication ability,

Figure 1. Artefacts as a mediating 'thing'
Adapted from Béguin, 2007.