Preface

The National Intelligence Council (National Intelligence Council, 2008) predicted that “everyday things” such as food packages, furniture, and paper documents will have their own internet nodes by 2025. And, according to Cisco, by 2030 there will be 500 billion connected devices to the Internet (CISCO, 2016).

The Internet of Things (IoT) will allow people and things to be connected anytime, anywhere, with anything and anyone, ideally using any path or network, and any service. This can and will be accomplished through a worldwide network of interconnected objects uniquely addressable, based on standard communication protocols (Atzori, Iera, & Morabito, The Internet of Things: A survey, 2010). Advances in the underlying technology are providing opportunities for new applications to evolve and, at the same time, their widespread use, is generating concerns that are quite distinct from the ones currently addressed on the Internet, namely the ones regarding security issues (Sundmaeker, Guillemin, Friess, & Woelfflé, 2010; Gubbi, Buyya, Marusic, & Palaniswami, 2013).

IoT aims to improve the quality of human life by automating some of the basic tasks that humans must perform. Creating and deploying smart objects allows offices, homes, industrial plants or even leisure environments to become “intelligent” and smart environments. These smart environments and spaces and self-aware things will largely contribute to the improvement of the general population’s healthcare and wellbeing (Miller, 2015).

As the IoT continues to develop, new opportunities that result in applications for the healthcare domain can be grouped into tracing and tracking of objects and people (ubiquitous identification of patients, health professionals, equipment and medicine), identification and authentication of people, automatic data collection and sensing (continuous communication improvements) (Islam, Kwak, Kabir, Hossain, & Kwak, 2015), among others.

Technology is changing and improving industry, with a significant potential and impact in healthcare. An extension of these emerging new approaches is tracking, which identifies a person or object in motion. For instance, patient identification enables an adequate and updated electronic medical record and allows for the re-
duction of harmful incidents such as wrong drug, or dose, or procedure. Sensors and multiple wireless technologies will enable real-time information monitoring on patient health indicators. Currently they can be applied to both inpatient and outpatient care, reaching for patients when in mobility and ensuring personalized medicine (Baldauf, Dustdar, & Rosenberg, 2007). Whereas, automatic data collection aims to reduce the amount of form processing time and process automation.

In fact, IoT proposes assisted living scenarios where sensors support the monitoring environment to ensure that both patients and the elderly have the desired life quality (Rashidi & Mihailidis, 2013; Calvaresi, et al., 2016). Furthermore, solutions that include wearables enables people to call for immediate assistance and provide real-time data collection. This is becoming a fashion trend that will be able to improve health quality and wellbeing (Gatzoulis & Iakovidis, 2007; Hiremath, Yang, & Mankodiya, 2014).

Heating systems that adapt to custom preferences and to weather conditions, energy savers that switch off electrical equipment when they are not needed, improve our wellness and well-being. In the last decades, air quality issues are gaining exposure and the overall population is more conscious of the burden and health impact of the air pollution (World Health Organization, 2016; Kullenberg & Kasperowski, 2016).

On the other hand, spending some leisure time at a museum or at the gym is an experience that can be improved with the use of IoT. This also relates to the personal and social domain where you establish and maintain relationships with friends. The potential impact that IoT has in our everyday life must be measured in terms of personal needs and social interaction (Atzori, Iera, Morabito, & Nitti, 2012).

**ORGANIZATION OF THE BOOK**

The book is organized into 10 chapters. A brief description of each of the chapters follows:

Chapter 1 reviews context-aware pervasive computing systems and ubiquitous healthcare systems. Smart systems include smart devices that need to adapt themselves automatically in response to a dynamic change of context. Some key challenges in the subject are presented and include topics such as context acquisition, modelling and reasoning, amongst others. The basic principles behind the design of such systems are presented, including several models for representing and reasoning upon contextual information and some frameworks specifically used for context-aware applications.

Chapter 2 analyzes the impact of current IoT in the current proliferation of Assistive Technology (AT). Some clear guidelines and the specific benefits to ensure the quality of lives of people with disabilities are yet to be developed and integrated
in existing and future applications. Furthermore, recent trends and issues relevant
to accessing technology for people with disabilities, are provided.

Chapter 3 presents Care4Me, an Assisted Living Facility (ALF) system, that
supports the daily activities of caregivers that work with people with disabilities.
This solution combines wearables with mobile technologies, and enables inhabitants
to call for immediate assistance (anywhere and at any time) and provides automatic
alerts of potential hazardous situations to assistants. Care4Me was assessed in the
field, both by professional caregivers and inhabitants of an ALF in Italy.

Chapter 4 reviews the current wearable healthcare systems. Furthermore, the
authors present existing customized integrated circuits (IC) for bio-sensing and
distinct printed electrodes (PE) available nowadays. Then, a hybrid integration of
flexible circuits, joining bio-sensing IC with PE assumes the shape of a Bio-Patch,
whose implementation is provided. This wearable and flexible Bio-Patch provides
an accurate electrocardiography (ECG) signal, similar to the one measured by a
bedside machine.

Chapter 5 provides a case study of a citizen science initiative that uses the Internet
of Things (IoT) to measure air quality. The citizen’s network is formed by early
adopters of the IoT that created tools available for measuring air quality. Several
issues regarding motivation, data reliability and accuracy, and the effective use of
the results are provided to question the success of this type of citizen mobilization
around public health concerns.

Chapter 6 also approaches the air quality issue bringing it to the next level. By
designing an integrated system that has an architecture that includes IoT as the data
source, uses Complex Event Processing (CEP) and a Service Oriented Architecture
(SOA) to detect certain event patterns and send real-time alerts to the interested par-
ties. A case study uses simulated sensors, made available through ThingSpeak, then
published through a Mule Enterprise Service Bus (ESB) application that converts
them into events sent to Esper, the CEP engine responsible for the real-time alerts.

Chapter 7 introduces one of the major concerns regarding IoT: synchronicity.
Particularly in healthcare contexts, synchronicity is fundamental to certify medical
accuracy when considering a new device. The chapter presents a model to measure
blood pressure, using the heart rate collected from arbitrary positions on the body,
and then relating the data to the rhythm of the heart. Thus, allowing wireless network
wearables to become a single health-monitoring scheme.

Chapter 8 analyzes the reliability of services provided in healthcare contexts
and introduces an extension to the Business Process Model and Notation (BPMN)
that provides reliability information to healthcare processes. Thus, designers of
IoT based systems are able to make informed decisions and choose from a set of
alternatives, using reliability information to select participants, execute services or
monitor process executions. The proposal is applied to an Ambient Assisted Living system, with an IoT-aware healthcare process.

Chapter 9 depicts a framework that represents how people, devices and communication technologies can interact, the PolySocial Reality (PoSR) framework. Developing systems that include IoT and smart environment paradigms, with location-aware messaging from sensors, can be ease by the direct application of this framework. In specific healthcare contexts, leveraging social awareness of software agents allows a more robust intra-sensor messaging.

Chapter 10 presents the Social Internet of Things (SIoT) paradigm and its application to the healthcare context. Through the usage of multi-agent technology, it is possible to develop a new generation of applications where the human-to-device social relationship is explored. A description of a specific condition, asthma, is presented to show how the access to exact and real-time information enable patients to be more aware of their close environment. Thus, with SIoT it becomes possible to address several challenges to improve efficiency in healthcare.

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REFERENCES


