Contents

Introduction xi

Imad SALEH, Mehdi AMMI and Samuel SZONIECKY

Chapter 1. Internet of Things (IoT): Concepts, Issues, Challenges and Perspectives 1

Imad SALEH

1.1. Introduction. 1
1.2. The connected object (CO). 2
1.3. Internet of Things: definition 3
1.3.1. Applications 5
1.4. Steps and technologies in the IoT ecosystem 5
1.4.1. IoT architecture 6
1.5. From the IoT to the Internet of Everything (IoE). 9
1.6. IoT and Big Data 10
1.7. Cloud computing applied to Big Data and the IoT 13
1.8. Data science and the IoT 13
1.9. Stakes and challenges of the IoT 14
1.9.1. Technological challenges 14
1.9.2. Societal challenges 15
1.9.3. Environmental challenges 16
1.9.4. Confidence in the IoT 16
1.9.5. Challenges for businesses 16
1.9.6. Challenges for researchers 17
1.10. Opportunities and threats in the IoT ecosystem 17
1.11. IoT security 18
1.12. Blockchain and the IoT 20
1.12.1. Definition. 20
1.12.2. Operation 20

1.12.3. Applications 22
1.13. Conclusion 22
1.14. References 24

Chapter 2. Deep Learning Approach of Raw Human Activity Data 27

Hamdi AMROUN, M'Hamed (Hamy) TEMKIT and Mehdi AMMI

2.1. Introduction 27
2.2. State of the art 29
2.3. Experimental configuration 33
2.4. Analysis of the activity 34
2.4.1. Neural network architecture 34
2.5. Results 41
2.6. Discussion 42
2.7. Conclusion 44
2.8. References 44

Chapter 3. Study and Development of a Smart Cup for Monitoring Post-stroke Patients' Activities at Home 53

Mehdi AMMI, Mehdi BOUKALLEL, Margarita ANASTASSOVA, Hamdi AMROUN and Maxence BOBIN

3.1. Introduction 53
3.2. Related work 55
3.2.1. Upper limbs motor assessment tools 55
3.2.2. New platforms for stroke assessment 56
3.2.3. Activity analysis and monitoring 56
3.2.4. Tasks and rehabilitation exercises for strokes 57
3.3. Design concept 58
3.3.1. Task identification 58
3.3.2. Monitored information 59
3.3.3. Sensory feedback 61
3.4. Implementation of the prototype 61
3.4.1. Grasping force detection 62
3.4.2. Liquid level detection 62
3.4.3. Orientation detection 63
3.4.4. Relative position detection 63
3.5. Data processing 64
3.5.1. Orientation calculation 64
3.5.2. Tremor detection 65
3.5.3. Activity recognition 67
3.6. Planned studies 72
3.6.1. Studies with therapists 72

3.6.2. Studies with patients 72
3.7. Conclusion and perspectives 72
3.8. References 73

Chapter 4. Enabling Fast-prototyping of Connected Things using the WiNo* Family 77

Adrien VAN DEN BOSSCHE, Réjane DALCÉ and Thierry VAL

4.1. Introduction 77
4.2. Context 79
4.3. State of the art 80
4.4. Introducing the WiNo* family 85
4.4.1. WiNoRF22 and TeensyWiNo 87
4.4.2. WiNoLoRa 89
4.4.3. DecaWiNo 90
4.4.4. Summary of WiNo nodes 92
4.5. Results and examples of use 93
4.5.1. WiNo and TeensyWiNo 93
4.5.2. WiNoLoRa 97
4.5.3. DecaWiNo 98
4.5.4. Summary and comparative analysis 99
4.6. Conclusion and outlook 100
4.7. Acknowledgments 101
4.8. References 101

Chapter 5. Multi-standard Receiver for Medical IoT Sensor Networks 105

Tarak ARBI and Benoit GELLER

5.1. Introduction 105
5.2. General context 106
5.2.1. OFDM 106
5.2.2. Characteristics of IEEE 802.11a/b/g/n/ac standards 107
5.3. The IEEE 802.15.6 standard 109
5.3.1. The WBAN frame 110
5.3.2. Specificities of the WBAN physical layer 111
5.4. Physical layer design 114
5.4.1. Frame synchronization 114
5.4.2. Frequency synchronization 115
5.4.3. Time synchronization 117
5.5. Simulation results 118
5.6. Conclusion 120
5.7. References 120

Chapter 6. Ambient Atoms: a Device for Ambient Information Visualization 123
Sébastien CROUZY, Stan BORKOWSKI and Sabine COQUILLART

6.1. Introduction 123
6.2. Previous research 125
6.2.1. Dedicated ambient displays that do not integrate a display screen 125
6.2.2. Generic ambient displays that do not include a display screen 126
6.3. Ambient Atoms: user's point of view 126
6.4. Ambient Atoms: hardware and software components 127
6.4.1. Hardware: microcontroller 127
6.4.2. Hardware: LEDs 128
6.4.3. Software 129
6.5. Ambient Atoms: prototype applied to the housing information visualization 130
6.6. Future research and conclusion 133
6.7. Acknowledgments 134
6.8. References 134

Chapter 7. New Robust Protocol for IoV Communications 137
Lylia ALOUACHE, Nga NGUYEN, Makhlouf ALIOUAT and Rachid CHELOUAH

7.1. Introduction 137
7.2. Latest developments 138
7.2.1. Architecture of the IoV 138
7.2.2. Communication obstacles 139
7.2.3. Related work 140
7.3. Multi-criterion routing protocol 145
7.3.1. Applications and services 146
7.3.2. Multi-criterion routing protocols in IoV communications 148
7.4. Conclusion and perspectives 159
7.5. References 161

Chapter 8. Interconnected Virtual Space and Theater: A Research–Creation Project on Theatrical Performance Space in the Network Era 165
Georges GAGNERÉ, Cédric PLESSIET and Rémy SOHIER

8.1. Introduction 165

8.2. A multidisciplinary experiment involving live performance and digital art 166
8.2.1. Defining avatar and mocaptor 166
8.2.2. System description 167
8.2.3. From Kinect to Perception Neuron: a new mobility 168
8.3. Acting relationship between the mocaptor and the avatar. 170
8.3.1. Controlling the avatar's spatial disposition. 170
8.3.2. The mocaptor's reference space: the Ninja Theory example 171
8.3.3. A closer look at the articulation of the reference spaces 173
8.3.4. Mobility of the mocaptor in their performance space. 174
8.4. From mocaptor to avatar from a technical perspective 175
8.4.1. Two-stage motion retargeting. 175
8.4.2. Avatar movement: combination of multiple sources 177
8.4.3. Combination with independent behavior: pathfinding 179
8.4.4. An architecture oriented toward interconnected objects 181
8.5. A practical application that raises new questions. 183
8.5.1. New experimentation spaces for actors, directors and digital artists. 183
8.5.2. The problem of visual composition for augmented scenes. 184
8.5.3. Redefining the role of the digital artist 187
8.6. Conclusion 188
8.7. References 188

Chapter 9. Mobile Telephones and Mobile Health: a Societal Question Under Debate in the Public Domain. 191
Brigitte JUANALS

9.1. Introduction. 191
9.2. An interdisciplinary activity sector and field of research: between connected health and connected well-being 193
9.3. "Boundary objects", socioeconomic strategies and innovative forms of sociotechnical mediation in equipped mobility 196
9.4. Mobile health-care service access systems: toward intermediation or disintermediation? 198
9.5. Forms of regulation of mobile health-care access: a legal, technical and sociopolitical issue under debate 204
9.6. Conclusion and new avenues of research 210
9.7. References 211

Chapter 10. Modeling Power to Act for an Ethics of the Internet of Things 215
Samuel SZONIECKY

10.1. Introduction 215
10.2. Principles of ethical modeling 216
10.2.1. Theoretical principles 217
10.2.2. Graphic principles 218
10.3. Calculating the complexity of an ecosystem 228
10.3.1. Existential complexity 228
10.3.2. Comparing the complexity of points of view 231
10.4. Automatic ecosystem enrichment 235
10.4.1. Constitution of raw data corpus 235
10.4.2. Transformation of raw data 238
10.5. Conclusion 241
10.6. References 243

List of Authors 247

Index 249